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NATURAL HISTORY.



FISHES.

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NATURAL HISTORY.

FISHES.

By P. H. GOSSE, A.L.S.

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NATURAL HISTORY.

FISHES.

THE Class of Fishes possesses a greater number of known species than any other of the primary divisions of Vertebrate animals; perhaps, indeed, when we consider the ratio which water bears to land on the surface of our globe, and the peculiar difficulties which attend the study of these animals, it may not be extravagant to suppose that the species of Fishes exceed in number those of Mammalia, Birds, and Reptiles put together. The number of individuals, also, composing the different species, in general, much exceeds the average as found in the other Classes, arising as well from the extent and depth of the element which they inhabit, as from their astonishing fecundity. The eggs of a bird are reckoned numerous when they amount to a score, but the eggs of fishes are commonly counted by thousands, and in some cases even by millions! In the ovary of a Cod, nine million eggs have been ascertained to exist, and Mr. Jesse asserts that "the ovary of one female Salmon will produce twenty million eggs." When we add that fishes yield an immense quantity of agreeable

and wholesome food to man, both in a fresh and salted state, and that they afford constant employment for millions of capital, fleets of shipping, and almost the whole population of large and numerous districts, it will be seen that this Class is not devoid of high interest, though, as compared with other animals, little is known of those details of manners and instincts, which constitute so large a part of the charm of Natural History.

Fishes are, for the most part, cold-blooded animals; their heart consists of but one auricle and one ventricle, which receive the blood from the veins, and send it to the gills for renewal; it is thence circulated through the body in arteries, aided by the contraction of the surrounding muscular fibres. The gills are organs for respiration analogous to the lungs of terrestrial animals, calculated to extract the oxygen needful for the renewal of the blood from the air contained in the water, not, as has been frequently supposed, by the decomposition of water itself. The apparatus is double, placed on each side of the neck, and, in its most common form, consists of several series of membranous plates, fixed on slender arches of bone. Over these plates, innumerable blood-vessels ramify, whose walls are so thin as to permit the fluid contained in them to absorb the oxygen with which they are thus brought into contact. In order to carry off the water when deprived of its oxygen, and to bring fresh portions in succession to be respired, a constant current is produced over the surface of the gills, by the fish taking in the water at the mouth, and ejecting it on each side, behind the

gills, through orifices for the purpose, called the gill-openings. The breathing apparatus is protected by large bony plates.

In most of the Bony Fishes there is found a membranous bladder, commonly of a lengthened form, placèd along the body between the spine and the bowels. It is filled with air, and is well-known as the air-bladder, or swimming-bladder. It varies in appearance; sometimes, as in the Hedgehog-fishes (*Diodon*), and their allies, it is two-lobed, more rarely it is double; in some genera, as in the Electric Eels, and the Carp family, it is divided by a transverse partition, which, in the latter, allows of intercommunication through a narrow orifice. In one of the Catfish family (*Pangasius*) it is divided into four compartments. In many species there are closed or blind tubular processes sent off from various parts of the surface; and in others it is subdivided into many irregular cells. From this structure it appears evident that the air-bladder is the lingering remnant of the lungs of air-breathing animals.

In some instances this bladder is found to be connected with the organs of hearing; but its chief function is the regulation of the specific gravity of the animal, aiding it in rising or sinking in the water, or maintaining any particular depth that its exigencies may require. In general, those species that swim at the surface, or that rove freely through the water, are furnished with this organ, while deep-water fishes are destitute of it; but there are many unaccountable exceptions. The air contained is found to vary in its character; but in marine fishes oxygen

preponderates, while in those of fresh-water, it is largely, or wholly composed of nitrogen.

The following fact recorded by Mr. Jesse shows that the possession of an air-bladder may, under some circumstances, expose fishes to danger.

“On the 9th, 10th, and 11th days of April, 1837, a friend of mine, then residing at Hastings, observed several fish floating on the surface of the water, and men and boys wading in, and pulling them out, the fish apparently making no effort to escape. On inquiry, he found that they were all Gurnards, no other fish exhibiting this phenomenon at that time, although he was informed that, a few years before, some Conger Eels were, during severe weather, in the same predicament.

“Some of the fishermen attributed the helplessness of the Gurnards to the circumstance of their having been blinded by the cold. Others said, the fish mistook the flakes of snow, which fell on the surface of the sea, for insects; and that, by leaping up so constantly and eagerly, for the purpose of catching them, they at last ‘blew themselves;’ meaning, that they so distended the air-bladder, that it lost its elasticity, or power of contraction, and thus they became helpless. On inspecting a fish just caught, the eyes were perfect; but upon opening the abdomen, and removing the air-bladder, the latter was found extremely distended. It is probable that the Gurnards came into shallow water in search of food, and the shallow water being much colder than the deep water, the fish became so benumbed, that when they had once distended the air-bladder to mount to the surface, the muscles had not power to compress it, and hence

they could not sink, and make off. It is, however, a curious subject for inquiry.”*

The *Diodon*, as is well known, has the habit of inflating its body with air, and of floating helplessly in this condition at the surface; but in this case it appears that the air is not taken into the bladder, but into the huge stomach, filling the cavity of the abdomen.

“A Gold-fish, in a small fountain, in the grounds of a gentleman of my acquaintance, swam about for more than two months, with its belly upwards. It appeared perfectly healthy and lively. This change from the natural position of the fish was, probably, owing to an enlargement or defect in the air-bladder.”†

In conformity with their structure, the sphere of activity of Fishes is the water. The Flying-fishes, and some of the Gurnards, are able to elevate themselves into the air, and to maintain their position there for a few seconds; and some of the Frog-fishes and Eels can crawl upon the exposed mud or sand, during the hours that intervene between the ebb and flow of the tide; but these exceptions scarcely break the universality of the law which confines Fishes to the water. There is, however, considerable diversity in the locality assigned to different species; some inhabit fresh-waters only, some only the sea; others are able to exist in both, either by periodical migration, or at pleasure. Of fresh-water Fishes, some inhabit large rivers, others small streams; rapid and sluggish waters have each charms for some: great inland lakes possess peculiar species, and some are found only in the

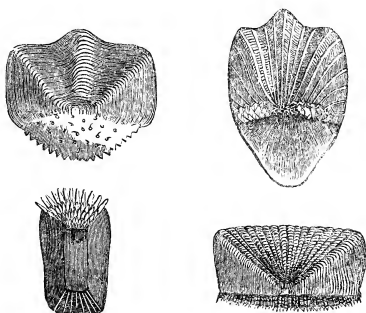
* Jesse's *Scenes of Country Life*, 353.

† *Ibid.* 356.

deep ponds, or *tarns*, of mountain districts. Of Marine Fishes, some roam the wide ocean, some play around the coral islands of the tropics, others affect the mud, or the sands of the shallows; some linger near the estuaries of great rivers; others come in mighty armies around the coast at particular seasons, retiring again to the deep water in the offing; finally, some habitually keep near the surface, while others rarely rise from the vicinity of the bottom.

The form of a fish is that best calculated to facilitate its progression through a fluid medium. It is commonly that of a spindle, swelling in the middle, and tapering to each extremity. There are, it is true, many modifications of this form; some, as the Skates and Flat-fishes, are flattened horizontally; others vertically, as the Chætodons and the Dory; some are globose, as the Diodons and Sun-fishes; some are drawn out into a serpent-form, as the Eels and Lampreys; and some, as the Ribbon-fishes, resemble in length and thinness the fabrics from which they derive their name. Yet, in all these varieties the normal form may, without difficulty, be traced. The surface of the body is sometimes smooth, or covered with a slimy secretion; occasionally it is armed with bony plates, which are sometimes set with hard tubercles; in a few species the body is covered with spines, which are capable of being laid close to the body, or erected at will; but the general covering of the body forms *scales*, or rounded plates (apparently horny, but considered by Professor Owen to be more allied to bone), the front margins of which are imbedded in the skin, and the posterior margins are loose and

commonly overlapping. "By maceration in water, scales exhibit a series of laminæ, the smallest in size having been the first produced; they resemble a cone, the apex of which is outwards, the smallest being in the centre; hence



SCALES OF FISHES.

the appearance of numerous concentric lines, all of the same shape, which mark the growth."*

Along each side, in most fishes, may be observed a line, known as the *lateral line*, formed by scales of peculiar form. They are commonly more bony than the other scales, and are pierced by a tubular orifice for the escape of a mucous secretion, which is poured out from glands beneath, and thus flows over the body for the double purpose of protecting the skin from the macerating influence of the surrounding water, and of diminishing friction in swimming.

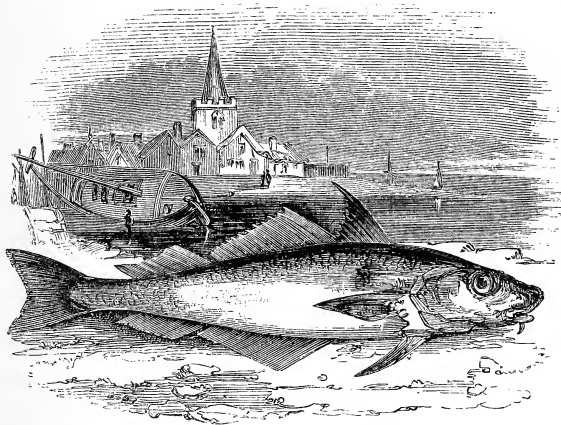
The organs of motion in this Class are the fins. They generally take the form of a delicate

* Yarrell, British Fishes, Introd. xii.

membrane, more or less transparent, stretched over parallel or radiating rays. These rays are slender bones, sometimes consisting of a single piece, stiff and spinous; at other times composed of several pieces jointed together, and therefore flexible; the latter are frequently divided each into two or more branches at the tip. These characters of the fin-rays afford a ground for the division of one of the Sub-classes into Orders.

The fins of Fishes are of five kinds, and are designated according to their position, as *pectoral*, or breast-fins; *ventral*, or belly-fins; *dorsal*, or back-fins; *anal*, or vent-fins; and *caudal*, or tail-fins. The pectorals and ventrals are arranged in pairs, and correspond to the fore and hind limbs in other vertebrate animals; the pectorals, for instance, representing the wings of birds, the ventrals the feet. The other kinds have nothing corresponding to them in the other Classes, except it be the web-like expansion of skin that fringes the Newts, &c., or the cartilaginous dorsal in some of the *Cetacea*. The dorsal runs along the medial line of the back; it was formerly supposed to preserve the body in a perpendicular position in the water, but recent experiments have shown that it is not necessary for that object, though it may be accessory to it. Almost all fishes have this fin, and many have two; while a few, as the Haddock and Cod, have three dorsals. The anal fin corresponds to the dorsal, but is placed beneath the body, just behind the vent. The caudal is the most important fin of all, being the great organ of motion. It is the termination of the body, being expanded around the posterior extremity. In those fishes

which are endowed with swiftness in swimming, the tail-fin is forked, each division being pointed, as are also the pectorals; while in those of sluggish habits, the caudal, as well as the pectorals, is commonly short, even, or rounded. It is by the force of the powerful strokes given obliquely right and left upon the water by this fin that the

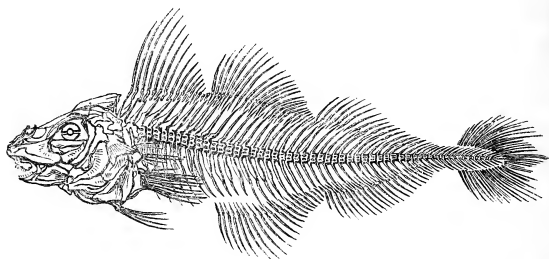


HADDOCK.

fish is urged onward in swift swimming; the pectorals and ventrals seem little used to communicate motion, except it be in deliberate change of place, for very short distances, or for turning; their chief use seems to be that of balancing the body.

The bones are less dense and compact in their structure than those of the preceding Classes;

yet in some of the Spiny-finned Fishes they possess much hardness. In one large division, including the Sharks and Rays, the skeleton is composed of gristle or cartilage instead of bone.



SKELETON OF HADDOCK.

The *vertebræ*, or joints of the spine, are excavated at each end in a conical cavity; the hollow thus formed between every joint and its neighbour is filled with a jelly-like substance, which is continuous through the whole spine, by means of a hole pierced through the centre of each *vertebra*. There is no true spinal marrow. In general, the tubular perforation is small, but in many of the Gristly Fishes it is of so great a diameter as to reduce the *vertebræ* to mere cartilaginous rings.

The *vertebræ* give origin to spinous processes, both above and below, for the attachment of muscles. Within the cavity of the belly the lower processes are wanting, and are replaced by lateral ones, to which the ribs are attached. These are commonly numerous, slender, flexible bones, each of which sends off a branch of almost equal length and tenuity; some species, as the

Herring and Pilchard for example, have similar thread-like branches sent off from each of the *vertebræ*; so that the bodies of these fishes seem filled with long and slender bones.

The skull varies much in form in different tribes, but in general consists of pieces answering to those which compose the head of the other VERTEBRATA. Teeth are generally very numerous; and are found in almost every one of the bones that enter into the composition of the mouth, though not in all the species. They are generally simple spines, curved backwards, but innumerable modifications of this form occur. Thus the jaws of the deadly Shark are flat and lancet-like, the cutting edges being notched like a saw; the front teeth of the Flounder are compressed plates; some, as the Wrasse, have flat grinding teeth; others, as the Sheep's-head, have the grinding surface convex; and others, as the genus *Chrysophrys*, have convex teeth so numerous and so closely packed over a broad surface, as to resemble the paving-stones of a street. The beautiful Chætodons of warm climates, on the other hand, have teeth which resemble bristles, and these are set close together like the hairs of a brush; while the Perch of our own rivers have them still more slender, minute and numerous, so as to resemble the pile of velvet. Another of our well-known fishes, the bold and fierce Pike, is armed with teeth scarcely less formidable in size, form, and sharpness, than the canines of a carnivorous quadruped. In number also there is great variety. The Pike, the Perch, the Catfish, and many others, have their mouth crowded with innumerable teeth, while the Carp and the

Roach have only a few strong teeth in the throat, and a single flat one above; and the Sturgeon, the Pipe-fish, and the Sandlance, are entirely toothless.

The blood, as already observed, commonly takes the temperature of the surrounding element; in some of the swift oceanic Fishes of the Mackerel family, however, such as the Tunny and the Bonito, the blood is found to be 10° higher than the temperature of the surface of the sea, even within the tropics: the flesh of these Fishes is dark and dense. The blood-disks are sometimes circular, sometimes oval; they are larger than those of Mammalia and Birds; smaller than those of Reptiles, and especially than those of Amphibia.

The brain is small, and is divided into a succession of lobes or ganglionic masses, "most of them exclusively appropriated to the function of a nerve of special sense." The senses are possessed probably in very different degrees. Touch is considered to be feebly exercised; but the thick and fleshy lips of the Wrasses, the whip-like filaments of the Anglers, the beards of the Cod and Barbel, and the long flexible fingers in the pectoral fins of the Gurnards may be the seats of special sensations of feeling. Taste is even still more dubious. The bony character of the mouth, and the manner in which the tongue is often covered with teeth, combine with the circumstance that the food is almost invariably swallowed whole the instant it is seized,—to forbid the supposition of acute taste.

The sense of smell is probably possessed in considerable perfection by Fishes. The olfactory

nerves are very large, and distributed over a great extent of surface. Professor Owen concludes, from certain anatomical peculiarities, that some Fishes, as the Rays, which have the olfactory nerves greatly developed, "*scent* as well as *smell*; i. e., actively search for odoriferous impressions by rapidly changing the current of water through the olfactory sac."* Many observations of living Fishes concur with deductions from structure to prove the exercise of smell. A Pike was seen to approach a dead Fish, but when within a foot of it, turned away, as if he had then become aware of what was the fact, that his supposed prey was stale. Mr. Couch observed, in a Stickleback, kept in a glass vase, that the nostrils opened and closed simultaneously with the action of the gill-covers, and felt convinced that the water was received and rejected for the purpose of sensation.† Mr. Jesse states that Fishes prefer paste and worms that have been prepared with particular perfumes.

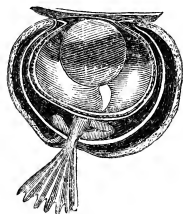
No external ear, nor even an auditory orifice is detected in Fishes, yet there is a complex internal apparatus of large size, for the reception of sounds. In many species of bony Fishes there is a communication between the acoustic chamber and the air-bladder, of which we shall presently speak. Mr. Jesse has seen Fishes start at the report of a gun, when they could not see the flash; and several instances are on record of tame Fishes having been taught to come to the surface of the water at accustomed sounds.

From the density of the medium inhabited by

* Comparative Anatomy, ii. 202.

† Yarrell, British Fishes, Introd. xix.

Fishes, a large number of the rays of light are absorbed and lost in passing through it; hence their eyes are very large, to collect as many of the remaining rays as possible. The *cornea* is flat, but the *crystalline* lens is perfectly spherical; the latter is familiar in the form of a white globule in a boiled Fish, the transparency being destroyed by heat. The *pupil* is large, and the *iris* is almost motionless. Eyelids are not present; and as the surface of the eye is always bathed by the surrounding water, there is no need for the secretion of tears.



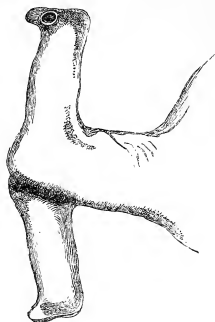
EYE OF SWORD-FISH.

The eyes of Fishes frequently reflect brilliant colours, red, orange, yellow, blue, and black, and not unfrequently display a pearly or metallic lustre, like that of gold or silver. These hues are due to a membrane called the *choroid*, spread around the back of the eye, composed largely of highly reflecting microscopic crystals. The eyes of some species gleam like those of quadrupeds.

In general the eyes are placed opposite each other on the two sides of the head, so as to look laterally, and (owing to the tapering of the head) a little forward. In some, however, especially such species as habitually live at the bottom, they are placed on the top of the head, and look vertically upwards. In one genus of Sharks, called, for this reason, Hammer-heads, the head is enormously widened, or lengthened sidewise, so as to present two long lateral processes, at the extremities of which are placed the eyes;

the figure of the head bearing no small resemblance to that of the hammer used in caulking ships.

Besides the senses which we have enumerated, which Fishes possess in common with other VERTEBRATA, there is another faculty with which some species are endowed, quite peculiar to this Class. It is the power of communicating electric shocks at will to other creatures. The Fishes most



HEAD OF HAMMER-SHARK.

noted for this property are the *Torpedo*, occasionally found on our own shores, and the *Gymnotus*, or Electric Eel, of South America. The electric organs consist of numerous six-sided cells, at first sight apparently composed of a clear trembling jelly, but really containing a great number of delicate membranous plates, separated from each other by a glairy fluid. In the *Torpedo* the prisms are placed vertically, and form two masses, one on each side of the head; in the *Gymnotus*, they are horizontal, and form four such organs, one pair on each side of the body.

The effects of fear in changing the colour of the human hair are well authenticated; from the statement of a writer in the "New Sporting Magazine," it would appear that Fishes may be subject to similar phenomena. "Into a pool of about four acres, partially surrounded with trees and terminating a range of other pools above, through

which constantly ran a small and irregular supply of waste water, about thirty brace of perfectly healthy Trout were turned, varying from three quarters of a pound to a pound each, and taken from a neighbouring mill-pool. The pool into which the Trout were turned, in the month of August, contained a great quantity of Roach, some Carp, Tench, and Perch, all healthy and thriving Fish: but the Trout, when taken out during the summer, and the following season, seemed to have increased very little in weight. With the exception of one healthy Fish of three pounds, nearly all the others were found to be either entirely blind or partially so, and doubtless would soon have died of starvation, as they were black, thin, and poor beyond belief. Those which were not too far gone to recover, I turned into a neighbouring brook: but what could have caused this effect upon the Trout alone, when all the other kinds of Fish, upon being taken out of the same water, were healthy and in perfectly good condition, I am at a loss to imagine. In the early part of the following March, I caught one of these Trout of about two pounds, which I had the preceding summer turned into the brook; and although it was of a very good colour, silvery and bright, it did not appear to be well fed, though no defect in the eyes could be perceived. Doubting whether to kill it or turn it in again for another day, I placed it in a small hoop-net, while I tried for another Fish, and threw the net into the stream. After taking two smaller Trout in very good condition, I took up the net and was surprised to perceive this silvery bright Fish become perfectly black; so that but

for its shape it could not have been known as a Trout. Trout when killed sometimes lose their colour; but here was a Fish which, but a few minutes before, was perfectly bright, and suddenly, while alive, had become totally discoloured and black in the water, though apparently uninjured in any way; and probably in a few minutes after being liberated, it would have regained its former beautiful hue.”*

The food of Fishes is for the most part animal. Some browse the seaweeds that wave around the rocks of the coast, and others nibble the soft parts of fresh-water vegetation; but the great majority are carnivorous. The immense number and variety of soft-bodied animals that inhabit the sea, the *Actinæ*, the *Medusæ*, the *Annellida*, and the naked *Mollusca*, afford food to multitudes; others are furnished with strong teeth to grind down the newly formed parts of coral, and devour the living polyps; and a large number feed greedily on Star-fishes, *Crustacea*, and the shelled *Mollusca*. In the fresh-waters, worms, leeches, and the larvæ of insects supply the appetite of many. But in addition to all these sources of supply, Fishes everywhere feed upon Fishes. The smaller are seized and devoured by those which are able to master them, and these again become the prey of their superiors; until every Fish sees in his fellow either a victim to be pursued and devoured, or an enemy to be avoided.

At first sight it seems a dreadful state of existence, this incessant preying of the stronger animals upon the weaker; and humbling indeed the contemplation of it should be to us, as a sad

* New Sporting Magazine, N.S. i. 404.

memento of sin ; for surely death in this our world is the bitter fruit of human transgression. “ By one man sin entered into the world, and DEATH BY SIN.” Yet the infliction is not to the animal creation an unmitigated evil. A far greater amount and variety of animal life is thus sustained than could be supported otherwise, and life to them is happiness. They have no terrors of futurity beyond death, and probably have little fear of death itself, beyond the habitual apprehension which prompts the exercise of caution and sagacity. Death is the pang of a moment, and is rather the termination of a pleasant active life, than an actual evil. The gradual exhaustion of strength by advancing age, or the dying of want from inability to procure the needful food, would be far more dreadful. Even the very exercise of the faculties arising from the present state of things,—the vigilance, the stratagems, the activity, the excitement involved in pursuit and attack on the one hand, and in escape or defence on the other, all are doubtless contributive to the relish of life, and to their consequent happiness. The poet’s judgment is according to truth :

“ Harsh seems the ordinance, that life by life
Should be sustain’d ; and yet, when all must die,
And be like water spilt upon the ground,
Which none can gather up,—the speediest fate,
Though violent and terrible, is best.
O with what horrors would creation groan,
What agonies would ever be before us,—
Famine and pestilence, disease, despair,
Anguish and pain in every hideous shape,
Had all to wait the slow decay of Nature !
Life were a martyrdom of sympathy ;
Death, lingering, raging, writhing, shrieking torture ;

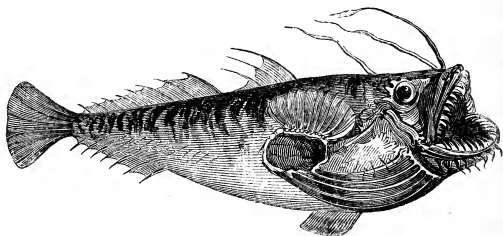
The grave would be abolished ; this gay world,
A valley of dry bones, a Golgotha,
In which the living stumbled o'er the dead,
Till they could fall no more, and blind perdition
Swept frail mortality away for ever.
"Twas wisdom, mercy, goodness, that ordain'd
Life in such infinite profusion,—Death,
So sure, so prompt, so multiform, to those
That never sinn'd, that know not guilt, that fear
No wrath to come, and have no heaven to lose." *

The voracity of Fishes is very great ; there seems no limit to their appetite but the actual capacity of their stomach. Mr. Jesse tells of a Pike, to which he "threw, one after the other, five Roach, each about four inches in length. He swallowed four of them, and kept the fifth in his mouth for about a quarter of an hour, when it also disappeared." Digestion, however, is very rapid in predatory fishes ; in a few hours not a single bone remains in the stomach or intestines of a Fish that has been swallowed. Mr. Frazer, in his "History of the Salmon," says, that he has found seven small Fishes in a Grilse (or young Salmon) of three pounds and a-half, and several Herrings in the body of Salmon, and that the digestion was so rapid that fire or water could not consume them more quickly. A remarkable example of the voracity of these animals is mentioned in the following extract from a lecture delivered before the Zoological Society of Dublin by Dr. Houston.

"This preparation (for the fidelity of which I can vouch, as it belongs to the Museum of the Royal College of Surgeons, and which may be taken as a fair average specimen of a Fish's breakfast party, captured at an early hour of the

* Montgomery's "Pelican Island."

morning) will serve as an illustration of the voraciousness of their habits. Here is the skeleton of a Frog-fish, two and a half feet in length, in the stomach of which is the skeleton of a Cod-fish two feet long, in whose stomach again are contained the skeletons of two Whittings of the ordinary size; in the stomach of each Whiting there lay numerous half-digested little fishes, which were too small and broken up to admit of preservation. The Frog-fish, with all these con-



FROG-FISH.

tents, was taken last summer by the fishermen, and offered for sale in the market, as an article of food, without any reference at all to the size of its stomach, which, to them, is an every-day appearance."

The ferocity with which the Trout tyrannizes over his fellows of the finny race is illustrated by the following graphic delineation, communicated to the "New Sporting Magazine;" which is interesting also for its notice of the habits of another species, far inferior in bulk, but fully equal to the Trout in pugnacity. The scene is a little limpid rill that flows down the side of Cheviot,

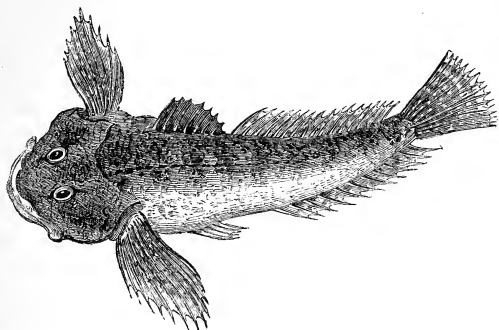
through Glendale, and loses itself in the sluggish Till.

“In the parching summer of 1826, I frequently retired with a book to a shady little retreat on the bank of this river, to spend a few hours in contemplative indolence, where, by a mill-dam fifty feet wide, with a sloping shore of fine sand receding into four feet depth of water, a little sort of fish-parlour was formed by a projecting willow, reaching several feet across the upper end. The spot I soon observed was tenanted by one large Trout, who played the tyrant to admiration, — saving that his sentences were always either annihilation or banishment, for there was no *torture*. When I sat quite still he did not appear to see me, and came so near that I could count the crimson speckles on his side, and see the inhalations and exhalations of his gills. The grace of his motions, when he moved from his station to see what was disturbing the surface of the water (a fly, or bit of palm-down), was beautifully contrasted with the violence with which he repelled every intruder upon his imperial territory. He flew at the victim like a bull-dog; but as I never saw him meet with his match, or one that would stand fight, I can form no opinion of his knight-errantry. He, however, allowed various sized Minnows to sport about the shore, his only food at this time appearing to be flies (who always fled at his approach to the shelter of the shore), and he did not condescend to eye these reserved victims of his appetite. This scene was repeated for many days together. But perhaps a more amusing one was that of a little Prickly-back [or Stickleback], a little knight armed *cap-*

a-pie. This small savage lay closely concealed underneath a bit of black stick whenever the trout was in sight; but the moment he could venture out with safety, away he went right into the middle of a shoal of infant Minnows, enjoying the sunshine in this early period of their existence on a little sandbank scarcely covered with water; he turned them over right and left,—retired and charged,—and charged again, as far as I could judge, out of pure mischief, for he neither ate nor injured them. The only interval of ease enjoyed by these unfortunate infants was when Tyrant Trout came to digest what he had caught, or to take a short *siesta*: then Mr. Pricklyback lay like a slave in the presence of his master, until his turn of indemnity arrived."

One of our native fishes, thence called the *Viviparous* Blenny, produces its young alive, and able to provide for their own support. But, in general, the continuation of the race is effected among fishes by means of eggs, called in the aggregate, *spawn*; and, before it is excluded, *roe*. It is often deposited in the gravelly beds of rivers, the female ploughing up a shallow furrow or trench for its reception, either with her muzzle or her tail, and then covering it up again. Others deposit their spawn in the sandy shallows of the sea, or wind it among rocks, or lodge it in bunches of seaweeds. In general, no parental care is displayed for the spawn after it has been deposited, but there are some interesting exceptions to the rule, Pennant states of the River Bullhead, that it deposits its spawn in a hole it forms in the gravel, and quits it with great reluctance. And this is confirmed by a correspondent of Mr. Yarrell, an

excellent observer. He remarks that this same species “evinces a sort of parental affection for its ova, as a bird for its nest, returning quickly to



RIVER BULLHEAD.

the spot, and being unwilling to quit it when disturbed.”

According to Fabricius, the male Lump Sucker, a British fish of grotesque form, but of brilliant colours, keeps watch over the spawn when laid by the female, and defends it with the utmost courage. Even the ferocious and formidable Wolf-fish approaches the nest at the risk of his life, for the Sucker, though so much smaller, and far more feebly armed, is yet able to infix its teeth in its adversary's throat, and inflict a mortal wound. If driven away by man, he does not go far, but is continually looking back, and soon returns. Our own fishermen in some respects confirm this account, and add that the young, when hatched, attach themselves to the sides of their careful

parent, who carries them into the security of deep water.*

The Pipe-fishes have a still more curious economy; for the male here acts as wet-nurse. He is provided with a pouch, like that of the Marsupial quadrupeds, into which he receives the spawn as it is deposited by his mate, and in which he carries it about until the young are hatched. But this is not all, for, as if to make the resemblance to the Marsupials complete, the young are in the habit of retiring for shelter into the parental pouch, for some time after they are able to leave it and roam at their own pleasure.

A species of Goby inhabiting the Mediterranean, is mentioned by Aristotle by the name of *Phycis*, as the only fish that makes a nest for the reception of its spawn. Modern naturalists confirm the accuracy (but not the exclusiveness) of the observation. The nest is composed of seaweeds and grass-wrack (*Zostera*); and the male guards the female during the act of spawning, and protects the young when developed.

Habits somewhat similar have been observed in certain species of the genus *Callichthys*, inhabiting the rivers of Demerara; one of which forms a nest of grass, another of leaves. These fishes are provincially known by the name of *Hassars*; the male and female remain by the nest till the young are hatched, with the solicitude of a hen guarding her eggs, and courageously attack any intruder. The negroes avail themselves of this boldness to capture them, for, on putting their hands into the water near the nest, and stirring it, the male Hassar, instead of retiring,

* Yarrell, British Fishes, ii. 367.

springs furiously at the hand, and is easily seized.

Mr. Audubon has described, in his peculiarly graphic style, the nest-making habits and parental devotedness of a fish found in the rivers of North America, which he calls the Sunny, or Sun-perch, but which appears to be a small species of *Labrus*.

“ The Sun-perch seems to give a decided preference to sandy, gravelly, or rocky beds of streams, avoiding those of which the bottom is muddy. At the period of depositing their eggs, this preference is still more apparent. The little creature is then seen swimming rapidly over shallows, the bed of which is mostly formed of fine gravel, when, after a while, it is observed to poise itself, and gradually sink to the bottom, where, with its fins, it pushes aside the sand to the extent of eight or ten inches, thus forming a circular cavity. In a few days, a little ridge is thus raised around, and in the cleared area the roe is deposited. By wading carefully over the extent of the place, a person may count forty, fifty, or more of these beds, some within a few feet of each other, and some several yards apart. Instead of abandoning its spawn, as others of the family are wont to do, this little fish keeps guard over it with all the care of a sitting bird. You observe it poised over the bed, watching the objects around. Should the rotten leaf of a tree, a piece of wood, or any other substance happen to be rolled over the border of the bed, the Sun-fish carefully removes it, holding the obnoxious matter in its mouth, and dropping it over the margin. Having many times witnessed this act of pru-

dence and cleanliness in the little Sunny, and observed that at this period it will not seize on any kind of bait, I took it into my head one fair afternoon, to make a few experiments for the purpose of judging how its instinct or reason might induce it to act when disturbed or harassed.

“Provided with a fine fishing-line, and such insects as I knew were relished by this fish, I reached a sand-bar, covered by about one foot of water, where I had previously seen many deposits. Approaching the nearest to the shore with great care, I baited my hook with a living ground-worm, the greater part of which was left at liberty to writhe as it pleased, and throwing the line up the stream, managed it so that at last it passed over the border of the nest, where I allowed it to remain on the bottom. The fish, I perceived, had marked me, and as the worm intruded on his premises, he swam to the farther side, there poised himself for a few moments, then approached the worm and carried it in his mouth over the next side to me, with a care and gentleness so very remarkable, as to afford me much surprise. I repeated the experiment six or seven times, and always with the same result. Then, changing the bait, I employed a young Grasshopper, which I floated into the egg-bed. The insect was removed, as the worm had been, and two attempts to hook the fish were unsuccessful. I now threw my line with the hook bare, and managed as before. The Sunny appeared quite alarmed. It swam to one side, then to another, in rapid succession, and seemed to entertain a fear that the removal of the suspicious object

might prove extremely dangerous to it. Yet it gradually approached the hook, took it delicately up, and the next instant dropped it over the edge of the bed." *

Some other examples of parental care and foresight have been lately brought under the attention of naturalists, which will be noticed in the following pages. The subject is one of great interest, and would probably repay careful observation with many facts hitherto unsuspected in this extensive but comparatively little-known Class of Vertebrate animals.

Mr. Jesse, in his "Gleanings," has given the following Table, showing the different degrees of fecundity in different species of Fishes.

Name of Fish.	Weight of Fish.		Weight of Spawn.	Number of Eggs.
	ozs.	drs.		
Carp	25..	5	2,571	205,109
Cod			12,540	3,686,760
Flounder	24..	4	2,200	1,357,400
Herring	5..	10	480	36,960
Mackerel	18..	0	1,223 $\frac{1}{2}$	546,681
Perch	8..	9	765 $\frac{1}{2}$	28,323
Pike	56..	4	5,100 $\frac{1}{2}$	49,304
Roach	10..	6 $\frac{1}{2}$	361	81,586
Smelt	2..	0	149 $\frac{1}{2}$	38,278
Sole	14..	8	542 $\frac{1}{2}$	100,362
Tench	40..	0		383,252

Fishes are capable of feeling attachment for each other. The pleasing writer just cited, "once caught a female Pike during the spawning season, and nothing could drive the male away from the spot at which the female had disappeared, whom

* Orn. Biog. iii. 50.

he had followed to the very edge of the water. A person who had kept two small fishes together in a glass, gave one of them away: the other refused to eat, and showed evident symptoms of unhappiness till his companion was restored to him."

The longevity of many fishes seems to be undoubted. Some well authenticated facts respecting Carp and some other domesticated species, go to prove that these have attained the age of a century. But the Pike seems to be still longer lived; one taken in Prussia in 1754 bore a ring which testified its having been put into the pond 267 years before: how old it was at that time was of course unknown. "Cartilaginous Fishes," observes Mr. Swainson, "from the nature of their bones, continue to grow all their lives; and as many of these, particularly the Rays, habitually live in the deep recesses of the ocean, and thus seldom run the risk of being captured by man, we may probably attribute their enormous and almost incredible size to their great age."*

The increase in size of other Fishes seems to have no definite limit, but proceeds during their whole life; their bodies instead of experiencing the rigidity of age, which appears to be the common cause of natural decay in terrestrial animals, maintain the elasticity of their parts undiminished; while as they increase in size and strength, they become more and more able to obtain and overcome their prey, and to defy their enemies. Hence probably it is a rare thing for a fish to die of natural decay; yet, when we consider the incessant warfare that

* Classification of Fishes, i. 48.

exists among the races, and the indefatigable assaults committed by man upon them, it is probable that the actual average of life among Fishes is of comparatively short duration.

Tenacity of life must be distinguished from its durability. In this property much difference is found amongst fishes. Mr. Yarrell observes that those species which swim near the surface of the water, have a high standard of respiration, a low degree of muscular irritability, great necessity for oxygen, die soon—almost immediately on being taken out of the water—and have flesh prone to rapid decomposition; of these, Mackerel, Salmon, Trout, and Herrings are examples. On the contrary, those that live near the bottom have a low standard of respiration, a high degree of muscular irritability, and less necessity for oxygen: these sustain life long after they are taken out of the water, and their flesh remains good for several days: Carp, Tench, Eels, the different sorts of Skate, and all the Flat-fishes are examples of this class. Some species, as the Eels and the *Ophiocephali*, continue to exhibit vigorous tokens of life, under inflictions that would be fatal to most other animals; the removal of the skin, and even the division of the body into pieces, not immediately producing death.

The power of sustaining extremes of temperature, found in this Class of animals, may perhaps be considered an indication of their low place in the scale of organization. Broussonet found, by experiments, that several species of fresh-water Fishes lived many days in water so hot that the hand could not be held in it a single

minute. Saussure found living Eels in the hot springs of Aise in Savoy, in which the temperature is pretty regularly 113° Fahr. But these cases yield in wonder to that recorded by Humboldt and Bonpland, who saw living Fishes, apparently in health and vigour, thrown up from the bottom of a volcano, with water and hot vapour that raised the thermometer to 210° Fahr.; a heat only 2° less than that of boiling water.

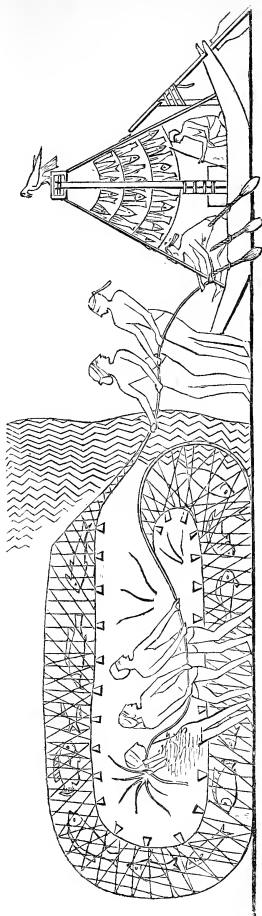
On the other hand, the cold of freezing does not always destroy the life of Fishes. In the north of Europe, Eels and Perch are conveyed from place to place in a frozen state, which revive on being thawed. The Grey Sucking Carp of North America, according to Dr. Richardson, may be treated in the same way. Mr. Jesse tells us that a friend of his had a Goldfish frozen with the water in a vase into a solid body of ice. He broke the ice around it, took it out, and found it to all appearance lifeless, and looking perfectly crystallized. Having left it in a warm room, after a few hours he found the ice thawed and the fish moving. In a little while it was as lively as usual. In such cases, "the fins quiver, the fish gradually turns itself on its belly, and moves slowly round the vessel; till, at length, completely revived, it swims briskly about."

We have briefly alluded to the value of Fishes as human food, a value which was appreciated in very early times. In the distinctions of clean and unclean meats imposed by the Law of Moses, Fishes are allowed to be eaten;—"whatsoever hath fins and scales in the waters, in the seas, and in the rivers, them shall ye eat." Still earlier

than this, the paintings which so copiously illustrate the manners of the ancient Egyptians, combine with the Holy Scriptures, to prove the fact that fish, both in a fresh and salted state, formed a large part of the food of that industrious people. "We remember," said the murmuring children of Israel, "the *fish* which we did eat in Egypt *freely*."

Among all nations, savage and civilized, the taking of Fishes has formed a prominent part of the occupation of man, and various stratagems and contrivances have been invented to facilitate the pursuit. The principal of these are the net, the spear, and the hook.

The first of these implements attacks the finny tenants of the waters in large numbers, and is rendered particularly effective



EGYPTIAN DRAG-NET.

from the fact that many of the most valuable Fishes have the habit of herding together in shoals. The engraving, copied from an Egyptian sepulchre, represents a very ancient form of drag-net used in the Nile; the fishers are stationed in part on the bank of the river, and in part on board of their fishing-boat, on the rigging of which the fishes are seen hanging up to dry for preservation.

Fishing by means of nets is frequently alluded to in the Scriptures, and in particular, it was the mode practised by several of the disciples of our blessed Lord, both before and after their sacred association with Him. The lovely Sea of Galilee often bore upon its waves the Son of Man, who, seated in the fishing-vessel of John or Simon, cheered their toil with His gracious words, as they launched out into the deep, and let down their nets for a draught.

Many are the varieties of this important accessory to human industry, the fishing-net; from the hoop-cast, which the fisher throws by hand over the surface-swimming fry to secure bait, to the elaborate *tonnaro* of the Italian shores, a mile in length. Most of those kinds, the pursuit of which is sufficiently important to be styled a *fishery*, are taken by nets of some kind or other. Thus on our own coasts, the Mackerel, the Herring, and the Pilchard, are taken chiefly by drift-nets, that is, nets of great length suspended perpendicularly from near the surface by a rope, to which corks are attached, and kept extended by a buoy, at one end; and by the fishing-boat riding on it, as if on her cable, at the other. The Sprat and the Whitebait are taken by bag-

nets, shaped somewhat like a funnel, with a wide mouth, diminishing to a narrow hose at the extremity. The Sole and the Gurnards are captured by means of a trawl, a net of somewhat similar form, but fitted for dragging over the bottom; and the Salmon is taken in several sorts of nets, varying much from each other, and peculiar to this valuable fishery.

The spear is little used with us as a fishing implement. In the north of Scotland, however, it is employed to strike Salmon, as at Invermoriston, where a river flows in a narrow chasm between two projecting rocks. "The fisherman seats himself on a cleft of this rock, right over the cascade, with a spear in his hand, which has a line fixed to the upper end of the shaft, similar to the practice of fishing for Whales with harpoons. Whenever the Salmon makes a spring to gain the ascent over the cataract, the spearman strikes the fish and lets the shaft go, holding only by the line until the fish has exhausted his strength; then the spear and fish are thrown ashore by the stream, and taken out at the lower side of the pool."

In ancient Egypt a favourite mode of fishing was that performed with a bident, or two-pronged spear. Like angling, it seems to have been an amusement of the higher orders, who were accustomed to use a boat made of papyrus, "in which they glided smoothly over the lakes and canals within their own grounds, without disturbing the fish as they lay beneath the broad leaves of the lotus plant." "On these occasions they were usually accompanied by some of their children, and by one or two attendants, who assisted



EGYPTIANS FOWLING AND SPEARING FISH.

in securing the fish, and who, taking them off the barbed point of the spear, passed the stalk of a rush through the gills, in order more conveniently to carry them home." Such a party is graphically represented in the above engraving, which is a fac-simile of an ancient Egyptian painting. The fisher is spearing the Booltee (*Labrus Niloticus*), while other species of the same genus, and a Mormyrus (*Scrophicephalus longipinnis*, Sw.) are swimming beneath the boat, the latter easily recognisable by its lengthened snout.

Among barbarous tribes the fish-spear is a favourite instrument. The North American Indian watches at a hole in the ice, with which the surface of his mighty lakes are covered in autumn, and strikes the fishes that play beneath; or stations himself in summer in a rude frame over some narrow gorge, through which a torrent foams and roars, whence he spears the great lake-trout that are driven down by the rapids. In the South Sea Islands fishing with the barbed spear is a favourite amusement. Before the introduction of iron, the implement was made of hard wood; ten or twelve pointed pieces being fastened to the end of a pole eight feet long; but now iron heads are usually employed, barbed on one side. With these spears the natives proceed to the reef, and wade into the sea as high as their waists, their feet being defended from the sharp points of the coral, and the spines of the sea-urchins by sandals made of tough bark, twisted into cords. Stationing themselves near an opening in the rocks, they watch the motions of the fishes, as they shoot to and fro; and dart the spear, sometimes with one hand, but more com-

monly with both, frequently striking their prey with great dexterity.

The fishermen often pursue their avocation by night; sometimes in the dark, sometimes by moonlight, but more usually by torch-light. Their torches are either large bunches of dried reeds firmly tied together, or else are made of the candle-nut, which the natives use to light their houses.

These nocturnal fishing expeditions are described as producing a most picturesque effect. Large parties of men proceed to the reef, when the sea is comparatively smooth, and hunt the Totara, or Hedgehog-fish, probably a species of *Diodon*; and it is a beautiful and interesting spectacle, to behold a long line of reef illuminated by the flaming torches, the light from which glares redly upon the foaming surf without, and the calm lagoon within. Each fisherman holds his torch in his left hand high above his head, while he poises his spear in his right, and stands with statue-like stillness, watching the approach of the fish.

A similar mode of fishing is practised in the rivers, and though the circumstances are different the effect is not inferior. "Few scenes," says Mr. Ellis, "present a more striking and singular effect, than a band of natives walking along the shallow parts of the rocky sides of a river, elevating a torch with one hand and a spear in the other; while the glare of their torches is thrown upon the overhanging boughs, and reflected from the agitated surface of the stream. Their own bronze-coloured, and lightly clothed forms, partially illuminated, standing like figures in relief;

while the whole scene appears in bright contrast with the deep and almost midnight gloom that envelopes every other object.”*

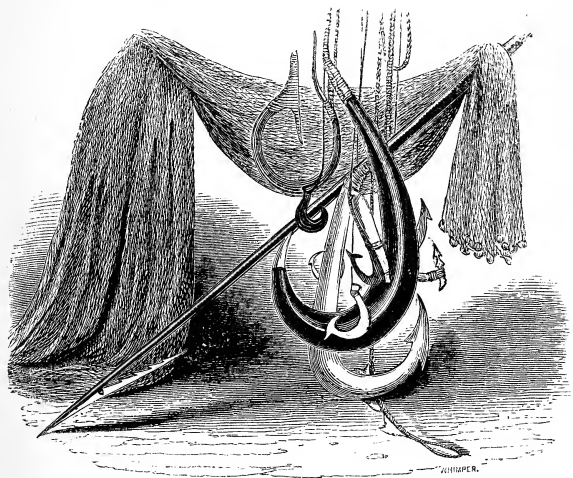
The hook and line claim as great an antiquity as the other implements of the fisher's art. In that which has been considered the most ancient of all compositions, the Book of Job, the Almighty Lord of nature, in one of the sublime appeals wherewith He humbles his too confident servant, says, “Canst thou draw out leviathan *with an hook?* or his tongue *with a cord which thou lettest down?*” In the burden denounced against Egypt by the prophet Isaiah, “they that cast angle into the brooks” are alluded to, in association with those “that spread nets upon the waters.” And though the disciples of our Lord seem chiefly to have used the net, they were familiar with the hook also; for when a *single* fish was required to furnish the tribute-stater, Peter was commanded by his Master to “go to the sea, and *cast an hook.*” The Egyptian monuments are not wanting in pictorial representations of this art any more than of the others already alluded to; individuals being depicted in the very act of “casting angle into the brooks.”

In our times the hook is extensively used, both by savage and civilized nations. In the beautiful islands that stud, as with clusters of gems, the broad bosom of the Pacific Ocean, around whose coasts Fishes of various species are peculiarly abundant, the ingenious and enterprising inhabitants have turned their attention to fishing with great success. Many artifices have been invented by them for this purpose, some of them most

* Polynesian Researches, i. 150.

effective, which cannot be classed under either of the three heads which we have named, being neither net, spear, nor hook. The last-named, however, in some form or other, is the principal device employed, and, strange as it may appear, notwithstanding all the superiority in art, and all the advantage of metals possessed by Europeans, the native-made hooks are preferred, as far more effective than ours. Many of them are really beautiful productions, and, when we consider their total want of metallic tools, excite our astonishment at the skill and ingenuity of the manufacturers. Our hooks are all made on one pattern, however varying in size; but the forms of theirs are exceedingly various, and made of different substances, viz., wood, shell, and bone. "The hooks made with wood are curious; some are exceedingly small, not more than two or three inches in length, but remarkably strong; others are large. The wooden hooks are never barbed, but simply pointed, usually curved inwards at the point, but sometimes standing out very wide, occasionally armed at the point with a piece of bone. The best are hooks ingeniously made of the small roots of the aito-tree, or iron-wood (*Casuarina*). In selecting a root for this purpose, they choose one partially exposed, and growing by the side of a bank, preferring such as are free from knots and other excrescences. The root is twisted into the shape they wish the future hook to assume, and allowed to grow till it has reached a size large enough to allow of the outside or soft parts being removed, and a sufficiency remaining to form the hook. Some hooks thus prepared are not much thicker than a quill, and

perhaps three or four inches in length. Those used in taking Sharks are formidable-looking weapons; some are a foot or fifteen inches long, exclusive of the curvatures, and not less than an inch in diameter. They are such frightful things, that no fish, less voracious than a Shark, would approach them. In some the marks of the Shark's teeth are numerous and deep, and indicate the effect with which they have been used.”*



POLYNESIAN FISHING-TACKLE.

The accompanying engraving represents many forms of hooks made of all these materials, as well as a net, a barbed spear, and a line armed with Shark's teeth, all copied from specimens

* Ellis.

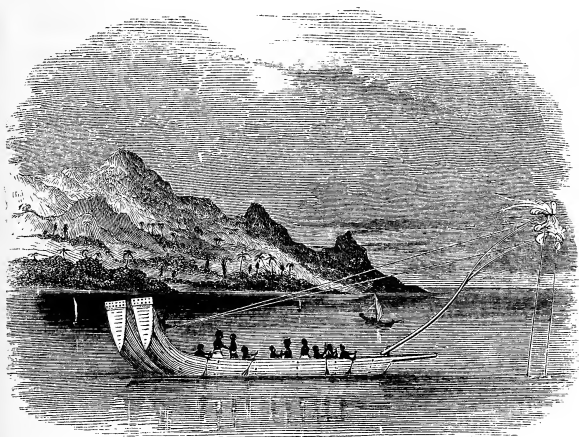
brought from the South Sea Islands, and deposited in the British Museum.

The most curious, as well as most serviceable hooks are made of the inner part of the shell of the Pearl-oyster, or rather large bivalves, the interior of which is pearly, called mother-of-pearl. These have great care and pains bestowed upon them: the smaller ones are cut almost circular, and made to resemble a worm, thus answering the purpose of bait as well as hook. A much larger kind is that used for the capture of the Albacore, Bonito, and Coryphene. The shank is about six inches in length, and nearly an inch in width, cut out of pearl-shell, in the shape of a small fish, and finely polished. The barb is formed separately; it is an inch and a half in length, and is firmly bound in its place by a bandage of fine flax. The line is fastened to this, and braided all along the curve of the hook, and again fastened at the head. Sometimes a number of long bristles are attached to the shell to mimic the appearance of the Flying-fish.

The line is affixed to the end of a long bamboo rod; and the anglers sitting in the stern of a light single canoe are rowed briskly over the waves. The rod is held so that the hook shall just skim the tops of the billows; the Albacore or Bonito, deceived by the resemblance, leaps after the fancied Flying-fish, and finds itself a prey. Twenty or thirty large fishes are occasionally taken by two men in this manner, in the course of a morning.

A still more ingenious mode of deception is practised upon these large Fishes, by employing a swift double canoe, from the bows of which

projects into the air a long curved pole resembling a crane. At some distance from the end, this divides into two branches, which diverge from each other. The foot is secured in a sort of socket between the two canoes, and is so managed



TAHITIAN ANGLING.

that the ends of the pole are capable of being lowered or elevated by a rope, which proceeds from the fork. A man sits in the high stern, holding this rope in his hand, and watching the capture of the fishes. From the end of each projecting arm depends the line, with the pearl-hook fashioned to resemble the Flying-fish. To increase the deception, bunches of feathers are fastened to the tips of the arms, to represent those aquatic birds which habitually follow the Flying-fish in its course, to seize it in the air.

The presence of these birds is so sure an indication of the position of the fish, that the fishermen hasten to the spot where they are seen hovering in the air. The canoe skims rapidly along, rising and falling on the waves, by which a similar motion is communicated to the hook, which skip along, sometimes out and sometimes in the water, while the plumes of feathers flutter immediately above. The artifice rarely fails to succeed; if the Bonito perceives the hook, he instantly engages in pursuit, and if he misses his grasp, perseveres until he has seized it. The moment the man in the stern perceives the capture, he hoists the crane, and the fish is dragged in, and thrown into a sort of long basket, suspended between the two canoes. The crane is then lowered again, and all is ready for another candidate.*

The use of the hook and line with us may be considered as divided into two branches; in the one these implements are employed as a trade, in the other as a sport. Several of our valuable fisheries are carried on almost exclusively with the hook; for example, Cod, Haddock, Whiting, Hake, Ling, Coalfish, Pollock, and other Fishes, all belonging to the great and important Cod family (*Gadidæ*), are taken in this manner, as well as the Turbot, Plaice, Flounder, and most other Flat-fish (*Pleuronectidæ*). There are two modes of line-fishing, neither of which requires the use of a rod. The first is by long lines, deep sea-lines, or bulters, as they are variously called, consisting of a strong line of great length, with an anchor at one end and a buoy-rope at the other. At regular distances along

* "The Ocean."

the length of this line, short lines, called snoods, are placed, each of which carries a baited hook. The long-line is shot *across* the tide and allowed to sink to the bottom, and hauled up to be examined after the lapse of a tide, or six hours.

The second method is by hand-lines; where the fisherman carries a line in each hand, each line armed with two hooks kept apart by a strong wire; a leaden weight is employed to sink the hooks, as these fishes feed near the bottom; and he continually tries with his hands whether he has hooked a fish. For Cod-fish, when bait is scarce, it is dispensed with by the use of an instrument, called a *jigger*, consisting of two large hooks soldered together in the shanks by means of lead, which is made to assume the size and form of a small fish; the points of the hooks are turned in opposite directions. This double hook is dropped without bait, and is continually moved up and down by jerks. The shining lead attracts many Cods, so that the *jigging* is almost sure to hook many of the fish in succession, and sometimes even two at once. Of course they are often sadly lacerated, and as the hooks frequently break out, the fish escapes in a wounded condition, and this is thought to have a tendency to drive the shoals from the ground.

The capture of fishes for amusement, so much practised in this country, is called Angling; and calling into action, as it does, skill and dexterity, as well as knowledge derived from experience and tradition, and embracing many rules embodied in treatises of acknowledged authority, is by some elevated to the rank of a science. It has been said that angling is pre-eminently an

English amusement. "The inhabitants of the British isles alone, with their colonial descendants, cultivate all matters pertaining to rural sports, of whatsoever kind they may be, but particularly hunting, shooting, and angling, with that persevering ardour, comprising active practice, and passionate study, which leads to perfection. In their efforts to acquire the surest, most amusing, most health-giving, and, I may say, most elegant modes of pursuing and capturing their game, be it the produce of field or flood, they call to their aid several auxiliary studies, amongst which stands prominent one of the pleasantest of all, viz., that of the natural history of animals, and of other things ranking not so high in the scale of creation."*

Angling may be considered as divided into three branches, which rise above each other in the skill required for their successful conduct, and therefore in the estimation of those who practise them. All require for their performance the use of a rod, a line, a hook, and a bait. The first is bottom-fishing, which nearly resembles that mode of sea-fishing with the handline, which we have just described. It consists of angling near the bottom of the water, with worms, gentles, bread, paste, and other animate and inanimate baits; it is the simplest, most common, and most primitive mode of angling, "first learned, and last forgotten."

Trolling is more difficult. It is performed in mid-water, that is, neither at the surface, like fly-fishing, nor at the bottom, as the preceding kind. More than one hook is required, and

* Ephemera on Angling, p. 6.

sometimes these are united into an implement of ingenious construction. A minute fish is the common bait, which is affixed to the hooks in a living state, and in such a manner as not to do it vital injury; but well-formed imitations, made of metal, or *cut-glass*, are substituted with success by those who have scruples about impaling the little minnow or dace. The bait, whether living or artificial, is sometimes affixed to the line by a swivel, and a bend being given to the tail, it is made to revolve rapidly on its long axis when drawn through the water. This spinning motion is very attractive to fish of prey, which eagerly pursue the dazzling object that seems to flee from them. Large Perch, Pike, and Trout, are taken by *spinning*. It is much used on the Continent by English travellers, as well as in the United States, and in Canada. All the large Thames Trout are taken with spinning-tackle.

But the perfection of angling is *fly-fishing*, which is performed at the surface of the water, the baits being in general artificial imitations of the various flies which flit about the surface, and attract the fish to leap up at them. The greatest skill is put in requisition to throw the bait so that it shall fall on the surface with the light elastic touch of the natural fly alighting, and shall imitate its fitful motions so perfectly as to deceive the practised eye of the wary and experienced Salmon or Trout beneath. "Other sports," says a master in the art, "may be more exciting than artificial fly-fishing, but there is not one requiring more skill, or calling into exercise more intelligence and adroitness of mind and body. A quick eye, a ready and delicate hand,

an apprehensive brain, delicacy in the senses of touch and hearing, activity of limb, physical endurance, persevering control over impatience, vigilant watchfulness, are qualifications necessary to form the fly-fisher. His amusing and chanceful struggles, teeming with varying excitement, are with the strongest, the most active, the most courageous, the most beautiful, and the most valuable of river fish; and his instruments of victory are formed of materials so slight, and some of them so frail,—they are beautiful as well,—that all the delicacy and cunning resources of art, are requisite to enable feebleness to overcome force. The large, vigorous, nervous Salmon, of amazing strength and wonderful agility; the rapid Trout, of darting velocity, hardy, active, untiring—whose dying flurry shows almost indomitable resistance—are hooked, held in, wearied out, by the skilful and delicate management of tackle that would, if rudely handled, be bent and strained by the strength and weight of a Minnow. 'Tis wonderful to see hooks of Lilliputian dimensions, gut finer than hair, and a rod, some of whose wooden joints are little thicker than a crow's quill, employed in the capture of the very strongest of river fish. The marvel lies in the triumph of art over brute force. If the sporting gear of the fly-fisher were not managed with art, on the mathematical principles of leverage, he could not, by its means, lift from the ground more than a minute fraction of the dead weight of that living, bounding, rushing fish, which he tires to death, nay drowns, in its own element. The overcoming of difficulties by the *suaviter in modo* forms one of the greatest charms

of fly-fishing, and to my fancy is the pleasantest element of success that can be used in any pursuit."*

The scenes in which the angler pursues his pleasant avocations are among the most delightful that Nature yields. The broad river, meandering through the meadows, here and there widening into calm and placid pools, that reflect in mirror-like perfectness the pollard-willows on the bank, and allow the eye to trace without difficulty the ruby-finned Roach and Perch, the gleaming Chub, and the speckled Trout, as they play or dart through the crystal element, cannot but be delightful; especially at that sweet season when spring is just maturing into summer, when the turf is full of scented flowers, the groves and hedges, dressed in the freshest livery of yellow-green, are pouring forth wild gushes of melody from a thousand throats, and myriads of painted flies and humming insects are enlivening the scene around. Here the bottom-fisher delights to station himself, quietly and patiently pursuing his sport until his pannier is full, or his leisure exhausted. And in such peaceful streams the more presumptuous troller spins his minnow, and calls his strength of limb and agility into exercise, as he drags from his hole the ferocious Pike.

But the fly-fisher resorts to widely different scenes. The swift torrent that pours down the mountain side, or roars along the narrow and frowning ravine; that here chafes and boils between moss-covered rocks, and there dashes over a rocky ledge in a sheet of foam; now forms a chain of

* Ephemera on Angling, p. 6.

deep pools, or rather holes, black from their very depth, and now rattles the pebbles over the shallow bottom with a hoarse, but not unpleasing music,—presents the prey that form his prizes. The scenery is wild and magnificent. The lofty mountain has to be climbed, often, it is true, with weary feet; but the air is fresh and invigorating, every step, as he rises higher and higher, makes him tread more proudly; the heather is soft and elastic, and its purple bloom is both beautiful and fragrant; and what a prospect does the summit reveal! He looks abroad over many leagues of country, all varied with hill and dale; he sees villages and towns, fields and woods, lakes and winding rivers, spread out like a map at his feet. Beneath, perhaps, he sees a yawning chasm of a thousand feet, at the bottom of which sleeps the unruffled *tarn*, with waters as black as ink to the beholder, yet of crystal clearness when examined in a glass, in which the crimson Charr play. The mountains, peak above peak, many of them crowned with caps of snow, stretch away in the distance, among which, like threads of burnished silver, gleam the little rivulets which the fly-fisher is seeking.

The Salmon, the various species of Trout, some of them little inferior in magnitude or strength to that kingly fish; the brilliant Grayling, with his dorsal like a butterfly's wing, and the Charr, with its refulgent sides, "the aristocracy of the finny race," inhabit these elevated streams and lakes; and for these does the enterprising fly-fisher visit the most remote and least accessible parts of our country. When we reflect that the first of these attains the weight of forty, fifty,

sixty, and even seventy pounds, and that Salmon of this weight yield to the skilful angler, "with a diminutive artificial fly, a thin silkworm-gut line, and a rod of pieces lighter and more limber than a lady's riding wand," we may well say that the fly-fishing art is one fully worthy of the sportsman's enthusiasm.

The charges of cruelty and frivolity have been often brought against angling by those who have taken no interest in its gentle excitement. From the former we fear it cannot entirely be cleared, at least so long as living vertebrate animals, whether frog, fish, or mouse, are used as bait. But adepts in the art have maintained that these are not necessary, mimic representations being made sufficiently true, to answer every purpose of the troller. The accusation of frivolity seems no more applicable to this than to any other recreation, while it has recommendations peculiarly its own. A host of brilliant names might be cited among the lovers of angling, especially of its highest branch, fly-fishing. To one of these we shall confide its defence, himself an able master of the art, and a pleasing describer of its charms.

"The search after food," remarks Sir Humphrey Davy, "is an instinct belonging to our nature; and, from the savage in his rudest and most primitive state, who destroys a piece of game or a fish with club or spear, to man in the most cultivated state of society, who employs artifice, machinery, and the resources of various other animals, to secure his object, the origin of the pleasure is similar, and its object the same. That kind of skill, however, which requires most

art, may be said to characterize man in his highest or intellectual state; and he who fishes for Salmon and Trout with the fly, employs, not only machinery to assist his physical powers, but applies sagacity to conquer difficulties: the pleasure derived from ingenious resources and devices, as well as from active pursuit, belongs to this amusement. Then, as to its philosophical tendency, it is a pursuit of moral discipline, requiring patience, forbearance, and command of temper. As connected with natural science, it may be vaunted as demanding a knowledge of the habits of a considerable tribe of created beings,—fishes and the animals they prey upon,—and an acquaintance with the signs and tokens of the weather and its changes,—and of the nature of waters and of the atmosphere.

“As to its poetical relations, it carries us into the most wild and beautiful scenery of nature; amongst the mountain-lakes, and the clear and lovely streams that gush from the higher ranges of elevated hills. How delightful is the early spring, after the dull and tedious time of winter, when the frosts disappear, and the sunshine warms the earth and waters, to wander forth by some clear stream, to see the leaf bursting from the purple bud, to scent the odours of the bank perfumed by the violet, and, enamelled, as it were, with the primrose and the daisy. To wander upon the fresh turf below the shade of trees, whose bright blossoms are filled with the music of the bee, and on the surface of the waters to view the gaudy flies sparkling like animated gems in the sunbeams, whilst the bright and beautiful Trout is watching for them below; to

hear the twittering of the water-birds, who, alarmed at your approach, rapidly hide themselves beneath the flowers and leaves of the water-lily; and, as the season advances, to find all these objects changed for others of the same kind, but better and brighter, till the Swallow and the Trout contend, as it were, for the gaudy May-fly, and till, in pursuing your amusement in the calm and balmy evening, you are serenaded by the songs of the cheerful Thrush and melodious Nightingale, performing the offices of paternal love, in thickets ornamented with the rose and woodbine."*

THE ANGLER'S SONG.

Merry in the greenwood is the note of horn and hound,
And dull must be the heart of him that leaps not to their sound ;
Merry from the stubble whirrs the partridge on her wing,
And blithely doth the hare from her shady cover spring :
But merrier than horn or hound, or stubble's rapid pride,
Is the sport, that we court, by the gentle river side.

Our art can tell the insect tribe that every month doth bring,
And with a curious wile we know to mock its gauzy wing ; [leap,
We know what breeze will bid the Trout through the curling waters
And we can surely win him from shallow or from deep ;
For every cunning fish can we a cunning bait provide,
In the sport, that we court, by the gentle river side.

Where may we find the music like the music of the stream ?
What diamond like the glances of its ever-changing gleam ?
What couch so soft as mossy banks, where through the noontide hours
Our dreamy heads are pillowed on a hundred simple flowers ?
While through the crystal stream beneath we mark the fishes glide,
To the sport, that we court, by the gentle river side.

For us the lark with upland voice the early sun doth greet ;
And the nightingale from shadowy boughs her vesper hymn repeat ;
For us the pattering shower on the meadow doth descend ;
And for us the flitting clouds with the sudden sunbeams blend :
All beauty, joy, and harmony, from morn to eventide,
Bless the sport, that we court, by the gentle river side.†

* Salmonia, p. 8.

† New Sporting Mag. v. 20.

In the classification of the very numerous species of Fishes now known to naturalists, the system of Cuvier is generally adopted, either with or without modification in the subordinate divisions. One of the most recent arrangements is that of the Prince of Canino, who, taking the system of Cuvier as the basis, has made some improvements in the distribution of the Families.* The knowledge, skill, and erudition of this eminent zoologist are universally acknowledged ; and in these pages we propose to adhere to his arrangement.

We divide the Class PISCES (*Fishes*) into four Orders, *Acanthopterygii*, *Malacopterygii*, *Plectognathi*, and *Cartilaginei*.

* This learned zoologist has during the present year (1850) published another system of Fishes, in which he has greatly multiplied the number of the Families ; but we prefer in this volume to adhere to his former arrangement. We shall, however, make use of this later publication, at least in estimating the number of species belonging to the different genera and families.

ORDER I. ACANTHOPTERYGII.

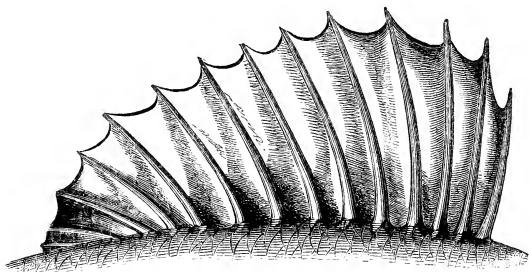
(Spiny-finned Fishes.)

THE skeleton in this large and very natural Order is composed of bone; the first rays (counting from the head backward), of the dorsal fin, of the pectorals, and of the anal, and, generally the first ray of the ventrals are unjointed, inflexible, and spinous. When there is more than one dorsal, the anterior is entirely filled with spinous rays. In some cases, as in the common Sticklebacks, the spinous rays are unconnected by a common membrane, and form free spines. The ventrals are, for the most part beneath the pectorals, or even in advance of them. The body is clothed with scales formed of successive laminæ or layers of horn-like, unenamelled bone, which have their free hinder margin cut into teeth. The swimming-bladder is not furnished with an air-duct leading into the gullet.

Nearly two-thirds of the species belonging to the whole Class of Fishes are found in this Order, which are scattered over all parts of the world, both in fresh and salt waters. Many of them are distinguished for elegance of form and beauty of colour; nearly all are fit for food, and some, as the Mackerel family, including the Tunny, support important fisheries.

The form of the dorsal fin is subject to much variation in this Order. Nearly half of the species have it divided into two, a spinous and a

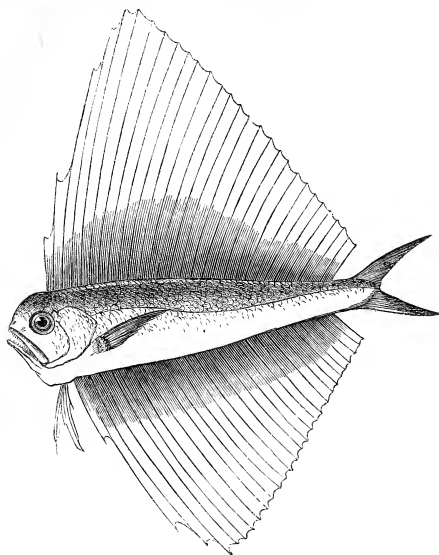
flexible one; a large portion of the remainder have the division indicated by a depression in the margin, or a cleft more or less deep, though the membrane is continuous. In some cases, as already intimated, the first dorsal is represented by a few detached spines, either quite destitute of membrane, or each furnished with its own.



DORSAL FIN OF PERCH.

In some of the Gurnards one or more of the spinous rays are greatly prolonged beyond the membrane; in the Dory the membrane is prolonged between the spines into lengthened threads; in the Sword-fish, the Opah, and the Gemmeous Dragonet, the anterior portion is elevated like a sail; while in the singular genus *Pteraclis*, of the American seas, figured on the opposite page, both the dorsal and the anal are so immense as to give to the vertical outline of this fish somewhat the form of a butterfly with expanded wings. The Gurnards have the pectorals unusually developed, so that some foreign species can use them as organs of flight through the air. Examples of this, in a less degree, may be observed in our native species,

which have these fins very large, and several long supplementary rays in front of them.



PTERACLIS.

The following seventeen Families of Acanthopterygian Fishes are enumerated in the synopsis of the Prince of Canino, who gives the affixed number of species known (in 1831) to belong to each.

	SP.		SP.
1 Percadæ	483	10 Cepoladæ	14
2 Sphyrænadæ.....	15	11 Teuthididæ	60
3 Mullidæ	42	12 Ophiocephalidæ....	40
4 Triglادæ	164	13 Mugilidæ	52
5 Sciænadæ	231	14 Gobiadæ	173
6 Sparidæ	158	15 Lophiadæ	40
7 Mænadæ	43	16 Labridæ	283
8 Chætodontidæ	157	17 Fistulariadæ	15
9 Scombridæ	262		
			Total 2232

FAMILY I. PERCADÆ.

(Perches.)

A vast assemblage of species, amounting to about one-seventh of the whole Class, is seen by the preceding table to be comprised in this Family. They are, for the most part, marine fishes, though the typical genus, which gives a name to the Family, inhabits fresh waters. The form is generally long-oval; the body is covered with scales, the surface of which is more or less rough, and the free margins of which are notched like the teeth of a comb; the scales do not extend upon the fins; the gill-cover (*operculum*), and the gill-flap (*preoperculum*), are variously armed with spines, and cut into teeth at their margins. Both the upper and lower jaw are set with teeth, besides which, the bones of the palate and the *vomer* (or middle ridge of the roof of the mouth) are furnished with them, so that there are five rows of teeth above, and two below. In general, all the teeth are fine, and set in close array, so as to bear a remote resemblance, in appearance, to the pile of velvet. The *branchiostegous rays*, or the slender arched bones of the membrane that closes the great fissure of the gills beneath, vary in number from five to seven. The ventral fins are, in general, placed under the pectorals; the dorsal is either double or depressed in the middle.

So immense a Family cannot but comprise several varieties of form, which, while agreeing in the important characteristics that distinguish these Fishes from those of the other Families,

differ considerably in subordinate points. Five leading types are seen to subsist, around which so many groups, called Sub-Families, are arranged. These we shall briefly notice.

The true Perches (*Percina*) have two distinct dorsal fins, with the membrane which connects the rays semi-transparent and nearly colourless. The pectorals and ventrals are obtuse, or somewhat rounded; the former contain each five soft rays; the latter are placed beneath the pectorals. The form of the body is oblong; the scales are comparatively large; the mouth is wide, and furnished with short and small teeth much crowded, without any larger pointed teeth, resembling canines, at the sides. The genus *Lucioperca*, as its name, signifying Pike-perch, expresses, has the structure of a Perch with the form and appearance, and even the ferocity of a Pike; while the *Diploprion*, of the coast of Java, and still more the *Enoplosus* of Australia, might readily be mistaken for a true *Chætodon*, having not only the short, high, compressed form of that genus, with its tall fins, but the small mouth, and delicate teeth, and even the characteristic colours and markings of *Chætodon*, the former being yellow, with a black vertical band through the eye, and another across the body, and the latter silvery white, with seven or eight vertical bands. Yet in each case the fins are destitute of scales, the gill-plates are spinous, and all the essential characters of true Perches, are exhibited.

The Serrans (*Serranina*), a very numerous sub-family, are distinguished by having the two dorsals united into a single fin, the place of the division being marked, however, by a depression

more or less deep in the outline. They have for the most part a larger acute tooth on each side of the mouth, resembling the canines of MAMMALIA. Their colours are generally beautiful, and frequently arranged in bands and spots, extending upon the fin-membranes. They are all marine, and nearly all tropical, but some are found in the Mediterranean, and two species have been met with on the coast of Cornwall.

The third Sub-family, named *Holocentrina*, or the Mailed Perches, are still more beautiful than the preceding. They are usually of small size, but of great brilliancy of colouring, the prevailing hues being various shades of red, ranging from the richest crimson to a gorgeous orange or golden hue. They are all clothed with bony, generally toothed, scales, which in some of the genera form a close impenetrable coat of mail. Not a single British example of this group is known, they being almost confined to the tropical seas.

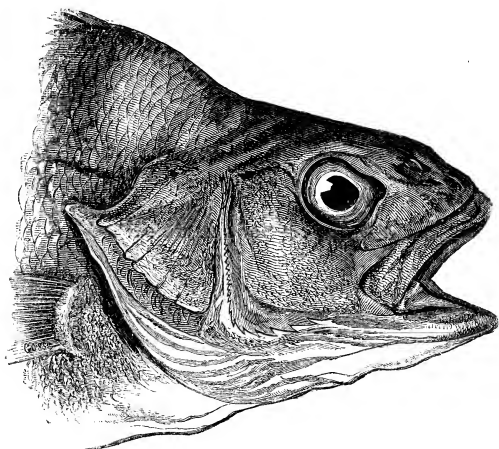
In the Jugular Perches (*Percophina*) the ventrals are placed beneath the throat, considerably in advance of the line of the pectorals. The head is pointed, and the lips generally thickened, as in the Wrasses (*Labridæ*); the body is remarkably lengthened. To this group belong some common British Fishes known as Weevers (*Trachinus*, LINN.), remarkable for the enormous length of the second dorsal and the anal, and for the formidable spines with which they are armed. These spines are the rays of the first dorsal, which are very sharp and strong, and a long lance-like spine on the gill-flap; wounds inflicted with which are believed to be poisoned. Whether

this be so or not, it is certain that they speedily exhibit symptoms of strong inflammation, attended with acute pain, extending to a great distance from the part lacerated. The Weever appears to be perfectly aware of the power of its weapons; it buries itself in the mud or sand at the bottom, with its mouth, which opens upwards, exposed. As it thus lies in wait for any passing prey, it may often be touched by an unconscious assailant, when instantly the little warrior strikes forcibly with his pointed spears, upwards and to each side. Pennant says of the Little Weever, that he has seen it direct its blows with as much judgment as a fighting-cock.

The last Sub-Family, the *Helotina*, "constitute," says Cuvier, "a group formed, as it were, to make naturalists despair, by showing how Nature laughs at what we deem characteristic combinations;" the genera possessing mutual relations sufficient to forbid their separation, and bearing a great resemblance to the other members of the common Family; while the species exhibit in the subordinate characters, such as the number, form, position, and even presence of the teeth, much diversity. None, however, have more than six gill-arches; they have no scales on the head, muzzle, or jaws; the dorsal spines, when depressed, fall into a longitudinal groove on the back; and the air-bladder is always divided into two distinct sacs, connected by a narrow neck. These too are chiefly inhabitants of warm latitudes, some marine, and some fluviatile; they do not possess much attractiveness of appearance, their colour being, in general, silvery grey, marked with dusky longitudinal lines.

GENUS *PERCA*. (LINN.)

The distinctive characters of the Perches proper are two dorsal fins quite separated, of which the fore one possesses only spinous rays, the hinder only flexible or soft ones. The tongue is smooth; the mouth is armed with teeth, situated in both jaws, in front of the vomer or middle



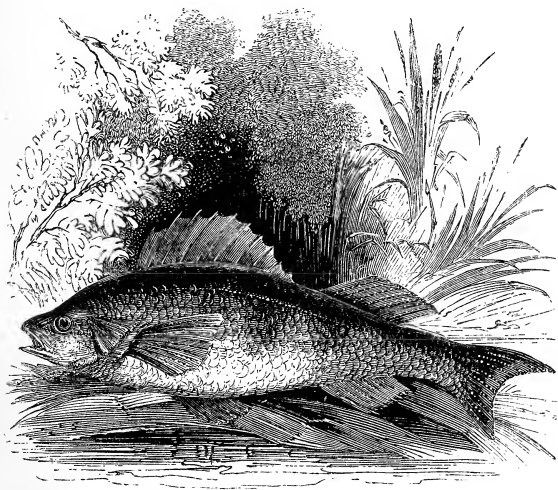
HEAD OF PERCH.

ridge of the palate, and on the bones of the palate itself; the fore gill-flap (*preoperculum*) is notched below, and has its hind edge cut into small teeth like those of a saw; the gill-cover (*operculum*) is bony, and terminates in a flattened spine pointing backwards. The gill-arches are

seven. The scales are rough, hard, and detached with difficulty.

The Common Perch (*Perca fluviatilis*, LINN.) is well known, not only to the angler, but to almost every country child; for it inhabits most of our lakes and rivers, especially where the banks are steep, and is so bold as to bite at nearly any bait. Hence this is usually the first fish that rewards the infant angler's enterprise.

It scarcely yields to any of our native Fishes in



PERCH.

beauty; its form is compact and powerful, and its colours attractive, especially when seen through the clear water in which it is playing. Its aspect,

however, when drawn from the water, is determined and almost ferocious, particularly when the high and spinous dorsal-fin is stiffly erected.

The excellence of the Perch, as a table fish, is generally acknowledged; in this respect, perhaps, it is exceeded by none of our fluviatile species, with the exception of the Trout and the Salmon. Perch of five pounds are not uncommon, and they have been known to attain even double this weight. A Fish of large size needs good tackle as well as skill in the angler, for it is powerful in proportion to its size. When Perch run large, a minnow, roach, or gudgeon is a successful bait; but the more usual baits are worms and gentles; fresh-water shrimps are much used by those who fish for Perch in the docks of London, where these Fishes are both fine and plentiful. In still water, as that of lakes or ponds, the bait should be allowed to float in mid-water; in rivers, nearer the bottom. In March, the Perch deposits its spawn, after which it will afford good sport to the end of October; a cool day with a fresh breeze to ruffle the surface, being most propitious.

The readiness with which this beautiful fish is taken is partly due to its voracity, in which it almost equals the ravenous Pike; when hungry indeed, it will seize almost any object that is presented to it. A writer in the *New Sporting Magazine*, says that he has repeatedly taken a Perch with no other bait than a portion of the gills of one just captured, accidentally remaining on the hook, the line having been carelessly allowed to drop into the water while a fresh bait was being selected. "Red seems an attractive

colour to them, and whether it presents itself in the blood of one of their former companions, or the hackle of a cock, is a matter of perfect indifference.”*

There are plenty of very fine Perch all along the Thames, but the most favourite resorts for these fish, are the deeps near Twickenham, either above or below the lock at Teddington, and in some deep holes about halfway between the lock and Hampton Wick; Perch have been taken in these places frequently as large as four pounds' weight each.

Very large Perch and Trout are taken in the rivers of Ireland, by a contrivance known as the *pooka*. It consists of a flat board, with a little mast and sail erected on it. Its use is to carry out the extremity of a long, stout line, to which are suspended at certain intervals, a great number of *droppers*, each armed with a baited hook. Corks are affixed to the principal line to keep it floating, and from a weather shore, any quantity of hooks can thus be floated over the water. The corks indicate to the fisher when a fish is on a dropper, and in a small punt he attends to remove the fish and rebait the hooks. Two hundred hooks are sometimes used on one *pooka*, which affords much amusement and a well-filled pannier.

This beautiful Fish appears to be common in the rivers and lakes throughout Ireland; in Scotland, however, it is rare, and in the waters that dissect, as it were, the northern portion of that kingdom, it is quite unknown. On the continent, it has a much more northern range; for large Perch,

* Vol. v. p. 277.

of five or six pounds in weight, are abundant in the lakes and rivers of Sweden, and afford good angling. The head of a Perch is said to be preserved in the church of Luehlah, in Lapland, which measures nearly twelve inches from the point of the nose to the end of the gill-cover, which, according to the proportion of parts in ordinary specimens, would give the enormous total length of four feet for this Fish. It is possible, however, that this may be the head of some other species.

Perch resort to pits, eddies, holes, the pillars of bridges, and mill-dams; they frequent the floors of staunches early in the morning, where they may be taken in great numbers at break of day, by means of a casting-net; in these places they work to meet the fresh water that oozes through.

The Perch has a tendency to ascend towards the springs of rivers, having a great repugnance to sea-water. It delights in clean swift streams with a gravelly bottom, not very deep; it is seldom found at a greater depth than a yard below the surface. It is tenacious of life, though perhaps less so than the Carp; it has been known to survive a journey of fifty miles, in the old days of travelling, when railways were unknown.

Like other "anglers' Fish," the Perch is not very often seen on the stalls of fishmongers in London. In Billingsgate market it is, however, sometimes exposed, especially on Fridays, as it is bought chiefly by Jews to form part of their Sabbath repast. We believe that this Fish is kept by the dealers in tanks, and that those which are not sold are frequently so little injured by

exposure, as to be returned to the water, where they soon recover.

O'Gorman describes the Perch as fond of noise, and as even sensible to the charms of music. One of his sons assured him that he had once seen a vast shoal of Perch appear at the surface, attracted by the sound of the bag-pipes of a Scotch regiment, that happened to be passing over a neighbouring bridge, and that they remained until the sounds died away in the distance.*

The Perch is a bold and fearless fish, and not a little destructive: small fry of all kinds are greedily devoured by him; he roots up the spawn-beds to feed on the deposited ova; small Roach and Trout are destroyed by him in great numbers, and even Trout of considerable size are often driven from their feeding-places near shore by this beautiful but tyrannical spinous-finned fish.

In the beautiful lake of Geneva the Perch is said to be subject to a singular accident. In the winter these fishes ordinarily remain at a considerable depth, where, from the superincumbent weight of so great a body of water, the air contained within the swim-bladder is much compressed. If now from any impulse a fish suddenly rises to the surface, the pressure being removed, the air forcibly expands, and not being able to find any outlet, the membranous bladder becomes greatly distended, sometimes to such a degree that it is forced out at the mouth of the fish, dragging the stomach, turned inside out, with it. In this sad condition, unable to sink, the

* Practice of Angling, ii. 2.

poor fish floats a few days on the surface, dragging out a miserable existence, until death puts a period to its sufferings. If, however, the bladder be pierced when in this state, the contained air escapes, the viscera recover their proper position, and the fish is saved.*

The Perch spawns at the age of three years, when it is about six inches in length; the month of April is the season for this operation if the water be moderately shallow; but in deep water the spawning is later. In a Perch of two pounds the roe weighs seven or eight ounces, and contains, according to Harmers, 281,000 eggs, but according to Picot, nearly a million; the number varying according to the age of the fish. Large and old fishes contain more ova than the smaller ones, which is not surprising, since the individual eggs are of the same size in both; they are very minute, and have been compared to poppy seeds.†

The Perch, when seen alive in a clear stream, is, as we have said, a beautiful fish. Perhaps the elevation of its back may be thought to detract from its elegance of form, giving it a humped appearance. The back rises somewhat abruptly just behind the head, after which it tapers to the tail: the height of the body, independent of the fins, is about twice that of the width. The general hue of the upper parts is a rich olive, crossed by five or six dark brown bands, which become inconspicuous after death. The sides have a brassy tinge, with pearly and steel-blue reflections about the cheeks; the under parts are pure silvery white. The two dorsal fins, and the pectorals take

* Cuv. et Val. Hist. des Poissons.

† Cuv. et Val. ii. 25.

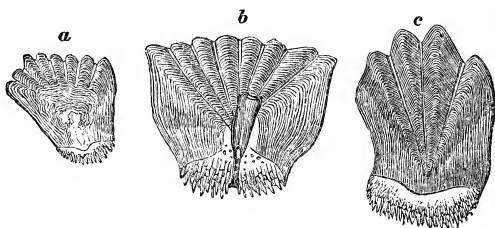
nearly the same hues as the parts from which they respectively arise ; but the caudal, the anal, and the ventrals have their rays of the most brilliant scarlet, especially the latter, and the membranes are tinged with the same hue. The iris of the eye is golden. The lateral line is distinct, running in a slightly arching line from the gill-flap to the tail-fin.

Mr. Yarrell mentions, as having been found in the waters of particular soils, specimens of the Perch almost entirely white ; and others of an uniform slate-grey hue with a silvery appearance. The latter variety is obtained in the ponds of Ravenfield Park, in Yorkshire, and is found to retain its peculiarity of colour, when transferred from its native ponds to other waters.

Yet another variation of hue, associated with another curious peculiarity, is ascribed to the Perch of Malham, or Maum Tarn, in Yorkshire, by Hartley, the author of an account of some natural curiosities of that neighbourhood. Speaking of these fishes, he says, " There is certainly a very extraordinary phenomenon attending them, the cause of which I leave to naturalists to ascertain. After a certain age they become blind : a hard, thick, yellow film covers the whole surface of the eye, and renders the sight totally obscured. When this is the case, the fish generally are exceedingly black ; and although, from the more extreme toughness and consistency of the membrane, it is evident that some have been much longer in this state than others, yet there appears no difference either in their flavour or condition. Perch of five pounds' weight and more have been taken. They are only to be caught with a net ;

and appear to feed at the bottom, on Loach, Miller's Thumb, and testaceous mollusca."

The scales of the Perch have their hinder, or free edge, set with fine crystalline points, arranged in successive rows, and overlapping. Their



SCALES OF PERCH.

front side is cut with a scalloped pattern, the extremities of undulations of the surface that radiate from a common point behind the centre. These undulations are separated by narrow furrows, across which, contrary to the ordinary rule, the close-set concentric lines that follow the sinuosities of the outline are not visible. Under the microscope they look as if they had been split in these radiating lines, after the whole number of layers had been completed, and that the fissures had then been filled with new transparent substance. The engraving above represents scales selected from different parts of the body of a Perch, and magnified. *a* is from the back; *b* is from the lateral line, and shows the tube for the passage of the lubricating mucus well developed; *c* is from the belly. The concentric lines, it should be observed, are much more delicate and close than could possibly be engraved without greatly enlarging the scale.

The nostril in the Perch has two external openings, surrounded by several orifices, through which issues a mucous secretion for the defence of the skin against the action of the water. "The distribution of the mucous orifices over the head," remarks Mr. Yarrell, "is one of those beautiful and advantageous provisions of Nature which are so often to be observed and admired. Whether the fish inhabits the stream or the lake, the current of the water in the one case, or progression through it in the other, carries this defensive secretion backwards, and spreads it over the whole surface of the body. In fishes with small scales, this defensive secretion is in proportion more abundant; and in those species which have the body elongated, as the Eels, the mucous orifices may be observed along the whole length of the lateral line."*

FAMILY II. SPHYRÆNADÆ.

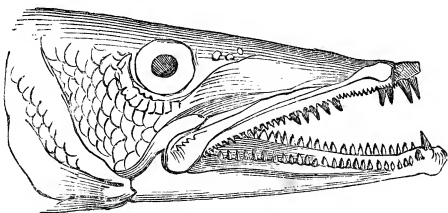
(*Sea-Pikes*).

The fishes of this Family were placed by Linnaeus among the Pikes, which they resemble in their lengthened form, in their strong and pointed teeth, and in the projection of their lower jaw. They are now, however, widely removed from that genus. Cuvier arranged them in the great Family of the Perches, with which they have many points in common; but the Prince of Canino forms them into a distinct Family.

They have the ventral fins placed considerably behind the pectorals, and the bones of the pelvis

* Brit. Fishes, i. 4.

are quite detached from the bones of the shoulders. The head is long, and the lower jaw projects beyond the upper, giving a ferocious aspect to the countenance, well borne out by the habits and powers of at least the principal genus. They have two dorsals, both placed far behind; the second is small, and in one of the genera (*Para-*



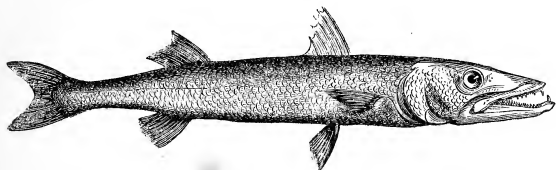
HEAD OF BARRACOOTA.

lepis), fleshy. The Family is very limited, containing only about fifteen living species, inhabiting the Mediterranean and the warmer parts of the ocean. There are, however, thirteen fossil species assigned to it.

GENUS *SPHYRÆNA*.

The technical characters of this genus are, that the body is slender and much lengthened; the jaws are long and broad, but of little depth; the mouth is large, armed with strong teeth, some of which are larger and stouter than the others; the chin is advanced and pointed; the two dorsal fins are triangular in form, remote from each other, and dividing the whole length of the body into three equal parts; the ventrals are placed beneath the first dorsal.

The Barracoota of the West Indies (*Sphyræna barracuda*, Cuv.), is reckoned among the number of marine monsters greedy of human flesh. It is common in the seas that wash those lovely tropical islands, where it attains the length of ten or twelve feet, though it is more generally met with about half that size. The thickness is not in pro-



BARRACOOTA.

portion to the length. The mouth is wide, the lower jaw projects beyond the upper, and is armed with formidable teeth, with two larger pointed canines in front; the upper jaw has many large and strong teeth scattered among minute ones. The two dorsals are placed far apart, the first immediately above the ventrals, the second above the anal. The formula of the fin-rays is as follows: D. 5; 1—9; C. 19; P. 12; V. 1—5; A. 1—9. The tail is much forked. The upper parts are dark greyish brown, becoming paler on the sides, the belly white. It is covered with small thin scales.

This formidable and voracious fish is much dreaded in the seas which it inhabits. It not unfrequently attacks and devours men while bathing; Dutertre affirms that it is even more dangerous than the dreadful shark, inasmuch as noise and motion, so far from intimidating it, only excite it

the rather to rush towards its victims. Notwithstanding this *anthropophagous* appetite, however, it is eaten with relish, and is publicly sold in the fish-markets. A graver objection to it is that it is occasionally poisonous, which the colonists believe is owing to its feeding on submerged "copper-banks," or else to its having eaten the deadly fruit of the Manchioneel-tree. If incautiously tasted under such circumstances, it is said to produce sickness, vomiting, and intolerable pain in the head, accompanied with loss of the hair and nails; and, in very bad cases, immediate death is the result. As a criterion of its wholesomeness, the teeth and liver are examined; if the former be white and the latter bitter, it is sound; but if the teeth be green and the liver sweetish, it cannot be eaten with impunity.

"What has been reported," observes M. Cuvier, "of the poisonous fishes of hot countries, and of that disease called *siguatera*, which they occasion in certain circumstances, is so curious and interesting, that I am justified in inserting the information collected by M. Plée on the Barracoota, which I have found in the papers of that unfortunate naturalist. Many persons, says he, fear to eat this fish because they have had frequent evidence of its causing disease, and sometimes death. This poisonous quality of the Barracoota belongs very certainly to a particular state of the individual, which appears to occur at different seasons of the year.

"I have consulted many persons with regard to the poison of the Barracoota; all have assured me that there is an infallible mode of determining whether it is, or is not, poisonous. For this end

they have only to observe if, in cutting it up, there flows away a sort of white water, or rather a kind of thin matter, which is, in every case, a certain sign that the fish is in the diseased state of which I have spoken above. D. Arthur O'Neill, Marquis del Norte, has told me that he has seen experiments tried on dogs, and that all have confirmed the exactness of this criterion. The symptoms of poisoning by the Barracoota are, a general trembling, nausea, vomiting, and acute pains, particularly in the joints of the arms and the hands. Sometimes the symptoms succeed each other with such rapidity that it becomes extremely difficult to determine with precision the different periods of the disease.

“When death does not terminate the malady, which happily is the more ordinary case, the virus is sometimes seen to cause pathological phenomena altogether singular. The pains in the joints become stronger; the nails of the feet and hands gradually fall away; the hair also, which is of a nature analogous to the nails, ends by falling off. These phenomena have been observed in many individuals, sometimes continuing during a great number of years. A person has been mentioned to me, who suffered in this way more than twenty-five years.

“It is a remarkable fact that when the Barracoota has been salted, it never causes any accident. At St. Croix, for example, they are in the habit of eating it only the day after it has been salted. Does salt act as an antidote to the poison of this fish?

“I have not myself been a witness of any cases of poisoning by the Barracoota, and I have only

recorded what I have been told by persons in other respects well instructed and worthy of credit.”*

FAMILY III. MULLIDÆ.

(*Surmulletts*).

This also is a Family of limited extent, arranged by Cuvier with the Perches. Its distinctive characters are these:—the shape is somewhat oval, but the fore parts are thick in proportion to the hind; the head is large, somewhat compressed, higher than broad; the profile is abrupt, approaching to a vertical line; the eyes are placed near the summit, but look laterally; the mouth is small, armed with minute teeth; the lower jaw is furnished with two fleshy beards (*cirri*), which depend from its under side; the line of the back is arched, that of the belly nearly straight; the gill-cover and body are clothed with large scales, easily detached: there are two dorsal fins, widely separated; the caudal is forked.

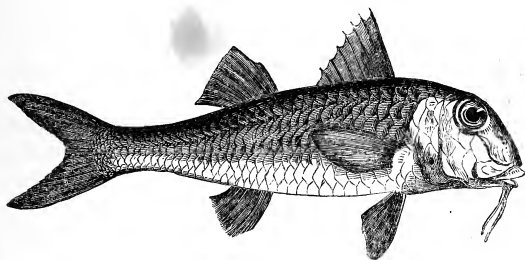
About fifty species are included in this Family, contained in two genera, *Mullus* and *Upeneus*. The former of these, containing but two species, is found in the Mediterranean and in the British seas; the latter and more numerous one, little differing from it in appearance or structure, is distributed over the tropical parts of the ocean. They are nearly all coloured with different shades of red, often varied with yellow or pale stripes; their flesh is much esteemed.

* Cuv. et Val. Hist. des Poiss. iii. 346.

GENUS *MULLUS*. (LINN.)

The European Surmullets are distinguished by having the characters already enumerated more strongly developed; the head is very abrupt, the profile nearly vertical, the gill-cover is smooth, and destitute of any spine; the teeth on the palate and in the lower jaw very minute.

Of the two species which form this genus, both of which are marked in catalogues as British, one is as common as the other is rare. The former is



SURMULLET.

the Striped Surmullet (*Mullus surmuletus*, LINN.), and is found in our fish-markets throughout the year, though in greatest abundance during the summer months. It is commonly about ten inches or a foot in length, and is rarely known to exceed fourteen inches. Its form and general appearance will be recognised from the accompanying engraving, but it should be seen alive, or at least just dead, to convey a notion of its beauty, which depends on its evanescent hues. The ground-

colour is a delicate pink, interrupted by three or four pale yellowish bands which run down the sides. The scales, however, which are very large, are removed with a slight degree of force; and wherever this occurs, there is a deposit of blood at the injured part below the outer skin; manifested by the colour becoming then of a purplish red, and hence we so commonly see this fish, especially after it has been handled, marbled with patches of purple and scarlet upon the delicate rose-colour of the ground.

The Surmullet is much esteemed for the table; the flesh is of agreeable flavour, and easy of digestion. It is customary to prepare it for cooking without drawing, like the Woodcock; the reason in both cases being that the food consists of soft molluscous or annellidous animals, of which little traces remain in the intestines. The Romans carried their admiration of this fish to a most extravagant pitch in the luxurious times of the Empire. The satirical poets, lashing the vices and follies of the age, have given us some particulars of this mania, only surpassed by the Tulip-madness which raged in Holland in the 17th century, when a sum equal to 425*l.* sterling, together with a carriage, horses, and harness, was given for a single bulb. One Calliodorus gave a sum of money equal to ten guineas for a Surmullet of four pounds' weight; one of six pounds was bought for 48*l.*; one still larger for 64*l.*; and three of equal size were purchased by the Emperor for the same entertainment at the enormous price of 243*l.* 10*s.* At length Tiberius attempted to restrain the extravagance by imposing a tax upon all provisions brought to market.

Messengers were sent at great expense to the most distant shores of the Mediterranean to procure these fishes, which, when brought home, were kept alive in vivaria or tanks of sea-water. By a refinement of luxury, the Mulletts were even brought to table alive, that the guests might feast their eyes upon the changes of hue which flit over the bodies of these fishes in the agonies of death. "The fishes," says Cicero, "swim under the couches of the guests. A Mullet is not considered fresh unless it actually die before their eyes; they gaze upon it exposed to view in glass bowls, and watch the various tints that play over it one after another as it passes from life to death." The species selected for this inhuman exhibition appears to have been the smaller and more rare *M. barbatus*, which is destitute of yellow stripes, and does not exceed six inches in length. The name of the genus *Mullus* is said to have been given to these fishes from their hue resembling that of the *Mulleus* or scarlet sandal worn by the Roman Consuls and Emperors.

The curious organs called beards (*cirri*) that are attached to the chin in these and some other fishes are connected with the search after food. Mr. Yarrell has some interesting observations on this subject, which we shall here quote from his valuable volume on British Fishes. "These *cirri* are generally placed near the mouth, and they are mostly found in those fishes that are known to feed very near the bottom. On dissecting these appendages in the Mullet, the common Cod, and others, I found them to consist of an elongated and slender flexible cartilage, invested by numerous longitudinal muscular and nervous fibres, and

covered by an extension of the common skin. The muscular apparatus is most apparent in the Mullet, the nervous portion most conspicuous in the Cod. These appendages are to them, I have no doubt, delicate organs of touch, by which all the species provided with them are enabled to ascertain, to a certain extent, the qualities of the various substances with which they are brought in contact; and are analogous in function to the beak, with its distribution of nerves, among certain wading and swimming birds, which probe for food beyond their sight; and may be considered another instance, among the many beautiful provisions of Nature, by which, in the case of fishes feeding at great depths, where light is deficient, compensation is made for consequent imperfect vision."*

The Striped Surmullet is occasionally taken in great abundance: the eminent zoologist just cited mentions five thousand taken in one night in Weymouth Bay, in August, 1819; and ten thousand sent from Yarmouth to the London market in one week, in May 1831. Their presence, however, is precarious; sometimes they become quite rare, where a day or two before they were abundant; other spots at the same time becoming the favoured scenes of their resort. They are principally taken with the trawl-net, which drags along the bottom of the sea.

* Brit. Fishes, i. 34.

FAMILY IV. TRIGLADÆ.

(Gurnards.)

Cuvier formed these Fishes into the second Family of the *Acanthopterygii* in his system, giving to the group, however, thus constituted, no other appellation than the descriptive one of "Fishes with hard cheeks." In these words their most obvious character is indicated, the head and face being encased in a solid buckler of bone, or in hard plates soldered together. In general, the plates as well as the gill-covers, are more or less armed with projecting spines. The technical distinction between the Gurnards and the Perches, to which Family they are very closely allied, consists in the bone beneath the eyes (the sub-orbital bone)—which is greatly dilated, so as to cover the cheeks,—being jointed to the gill-cover. Those curious fishes of the Perch family, the Stargazers (*Uranoscopus*), have the head mailed and angled much in the same way as the Gurnards, and have their eyes directed even still more vertically; but, in that genus, the sub-orbital bone, though very broad, is united with the temporal bones, and not with the gill-cover.

The fins are well developed; especially the pectorals, which often assume gay colours, and dimensions so great, that, like the true Flying fishes of another Order (*Exocætus*), these fishes are capable of projecting their bodies into the air, and of taking long leaps. Some genera have several finger-like rays, unconnected by membrane, in front of the pectorals; which probably

serve them as organs of touch, endowed with a sensibility to impressions that are indispensable in the situations where they haunt, as bottom feeders.

About two hundred and sixty species are enumerated in the Family, of which just one tenth part are European.

To this Family belongs a genus of fishes containing many well-known inhabitants of our coasts and rivers, the Sticklebacks (*Gasterosteus*). We have seven species, all of them of small size, some of which are familiar to every truant school-boy by their abundance, their pigmy dimensions, their armature of spines and plates, their vivacity and boldness, and the beautiful tints of green, crimson, and silver, with which they are frequently adorned.

These little fishes, however, present other claims to our attention; for they afford additional examples of an instinct which has been considered almost if not quite unknown in the Class to which they belong, that of nest-building. The habits of one of these species, which appears to be the commonest of the Three-spined Sticklebacks (*G. trachurus*) have been described by a careful observer in a little-known periodical, called "The Youth's Instructor;" and his account carries its own guarantee of correctness with it. "In a large dock for shipping on the Thames," observes this writer, "thousands of these fish were bred some years ago; and I have often amused myself for hours by observing them. While multitudes have been enjoying themselves near the shore in the warm sunshine, others have been busily engaged in making their nests, if a

nest it may be called. It consisted of the very minutest pieces of straw, or sticks, the exact colour of the ground at the bottom of the water, on which it was laid: so that it was next to an impossibility for any one to discover the nest, unless he saw the fish at work, or observed the eggs. The nest is somewhat larger than a shilling, and has a top or cover, with a hole in the centre, about the size of a very small nut; in which are deposited the eggs, or spawn. This opening is frequently concealed by drawing small fragments over it; but this is not always the case. Many times have I taken up the nest, and thrown the eggs to the multitude around, which they instantly devoured with the greatest voracity. These eggs are about the size of poppy-seeds, and of a bright-yellow-colour; but I have at times seen them almost black, which I suppose is an indication that they are approaching to life. In making the nest, I observed that the fish used an uncommon degree of force when conveying the material to its destination. When the fish was about an inch from the nest, it suddenly darted at the spot, and left the tiny fragment in its place; after which it would be engaged for half a minute in adjusting it. The nest, when taken up, did not separate, but hung together, like a piece of wool. The place chosen by these fishes for their nests is where the ground forms an inclined plane, and in about six inches of water I think they breed early in the month of August."

Another species of the same genus, the largest which is found on our shores, the Fifteen-spined Stickleback (*G. spinachia*), sometimes called the

Sea-adder, is endowed with a similar instinct. The author of a communication to the Royal Institution of Cornwall, republished in the "Zoologist," thus records his observations:—"During the summers of 1842, and 1843, while searching for the naked mollusks of the county, I occasionally discovered portions of sea-weed and the common coralline hanging from the rocks in pear-shaped masses, variously intermingled with each other. On one occasion, having observed that the mass was very curiously bound together by a slender silken-looking thread, it was torn open, and the centre was found to be occupied by a mass of transparent amber-coloured ova, each being about the tenth of an inch in diameter. Though examined on the spot with a lens, nothing could be discovered to indicate their character. They were, however, kept in a basin, and daily supplied with sea-water, and eventually proved to be the young of some fish. The nest varies a great deal in size, but rarely exceeds six inches in length, or four inches in breadth. It is pear-shaped, and composed of seaweed or the common coralline, as they hang suspended from the rock. They are brought together, without being detached from their places of growth, by a delicate, opaque, white thread. This thread is highly elastic, and very much resembles silk, both in appearance and texture; this is brought round the plants, and tightly binds them together, plant after plant, till the ova, which are deposited early, are completely hidden from view. This silk-like thread is passed in all directions through and around the mass, in a very complicated manner. At first,

the thread is semi-fluid, but by exposure it solidifies; and hence contracts and binds the substances forming the nest so closely together, that it is able to withstand the violence of the sea, and may be thrown carelessly about without derangement. In the centre are deposited the ova, very similar to the masses of frog-spawn in ditches. . . .

“It is not necessary to enter into minute particulars of the development of the young, any further than to add that they were the subject of observation till they became excluded from the egg, and that they belonged to the Fifteen-spined Stickleback (*Gasterosteus spinachia*). Some of these nests are formed in pools, and are, consequently, always in water: others are frequently to be found between tide-marks, in situations where they hang dry for several hours in the day; but whether in the water or liable to hang dry, they are always carefully watched by the adult animal: on one occasion, I repeatedly visited one every day for three weeks, and invariably found it guarded. The old fish would examine it on all sides, and then retire for a short time, but soon returned to renew the examination. On several occasions I laid the eggs bare, by removing a portion of the nest; but when this was discovered, great exertions were instantly made to re-cover them. By the mouth of the fish the edges of the opening were again drawn together, and other portions torn from their attachments and brought over the orifice, till the ova were again hid from view: and as great force was sometimes necessary to effect this, the fish would thrust its snout into the nest as far as the eyes, and then jerk back-

wards till the object was effected. While thus engaged it would suffer itself to be taken in the hand, but repelled any attack made on the nest, and quitted not its post so long as I remained; and to those nests that were left dry between tide marks, the guardian fish always returned with the returning tide, nor did they quit the post to any great distance till again carried away by the receding tide."

It is right to observe that Mr. Couch, who in his "Illustrations of Instinct," quotes both of the above papers, suspects that the nest, in the latter case, was that of the Shanny (*Blennius pholis*), and that the Sticklebacks watched it with a very different motive from parental affection. We do not, however, concur in this gentleman's conclusions.

GENUS *TRIGLA*. (LINN.)

The Gurnards have the head somewhat four-sided, more or less resembling the half of a pyramid divided vertically; hence the profile resembles that of the Surmulletts. It is, as has been intimated, defended by long shields, those of the gill-cover and shoulder terminating in a spine or lancet. The body is lengthened, rounded above, with the belly flattened, tapering from the head backwards; clothed with small prickly scales, firmly embedded in the skin, very compactly arranged, and often accompanied by rows of spines placed along the lateral line. There are two dorsal fins, the first short but high, with spinous rays; the second long, with rays flexible at the tips. The pectorals are large, with strong

rays, and with the membrane often coloured; there are three free rays before the base of each, covered with a fleshy skin, well supplied with nerves. The ventrals are also large, and situated immediately beneath the pectorals. The anal corresponds with the second dorsal. The caudal is slightly lunate, or hollowed at the extremity. Both of the jaws, and the front of the vomer, are furnished with minute, close-set teeth. The gill-opening is large, and the branchiostegous rays are seven.

The swimming-bladder in this genus is rather large, and presents considerable diversity of form. In general it is somewhat heart-shaped, more or less cleft in front, but in the Sapphirine Gurnard, presently to be described, it is triple, the principal sac giving off, on each side, an accessory sac, tapering off to a point behind, but united to, and opening into, the main chamber at the front part. The membranes of which this organ are composed are thick, dense, and leathery.

Notwithstanding this development of the air-vesicle, the Gurnards are ground-fishes. They chiefly haunt the vicinity of the bottom, where they feed on crabs, lobsters, and other crustacea; not, however, confining themselves to these, for they are very voracious.

The Grey Gurnard (*Trigla gurnardus*, LINN.) seems to affect the surface more than the other species of the genus. On the Atlantic shores of Scotland and Ireland it is not uncommon to see immense shoals of this *Crooner*, (as it is called on the former coast,) rippling the smooth water as they cut the surface, so as to be readily shot with a fowling piece.

The principal mode of taking Gurnards is by means of the trawl-net, a long conical net already described, dragged along the bottom after a boat under sail. But the Grey Gurnard is taken on the coast of Ireland, by the fleet-line, like the Mackerel. A writer in the "New Sporting Magazine," who well describes him as "all points and angles," his "huge horny bony head, armed at all points with barbs and thorns," his "tremendous dorsal fin, a natural *chevaux de frise*, for the hand of the incautious fisherman;" and, as to his habits, as "living perpetually on the surface, and being prodigiously gregarious and voracious beyond all example," says, "I have sailed through them in shoals to which the eye could see no limit, rolling lazily on the water, with the points of the fin projecting over the surface, and swallowing everything which came within view. In the summer months their sole food is the herring-fry; and I have often found them gorged with the miserable little fish to an extent which their size would seem to render absolutely impossible."

"In unhooking the Mackerel there is no difficulty. It is not so, however, with his friend and companion the Gurnard. He is a far more dangerous customer, even, than the Perch, the terror of the inexperienced river angler. The moment your hand touches him,—whisk! up fly the back fin, the thorns of the head, and the whole array of points and barbs with which he so liberally provides you; and it may be that your lacerated fingers will remind you for several days of the necessity for caution in every future attempt. The ordinary method of avoiding this inconvenience,—more serious than might perhaps

be imagined, has somewhat of cruelty about it. It is to stun the fish by a hard knock against the deck or gunwale of the boat. The fins and thorns are thus erected before the fisher places his hand upon the fish; he sees the danger, and is enabled to keep clear of it. But the end may be attained as securely without recourse to this cruel expedient. Any one who has ever taken a Pike off the hook, will at once perceive the plan. Let the Gurnard be seized with the fingers between the eyes, just as the Pike, and the hand will be secured against all danger.”*

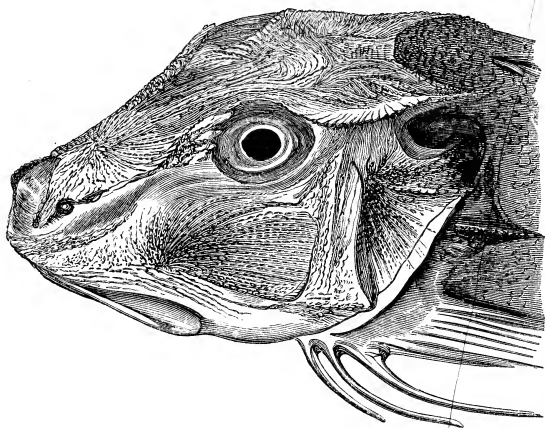
The word Gurnard is supposed to be derived from the French *gronder*, to grumble; and to indicate the power, rare among fishes, but possessed by all the species of this genus, of emitting vocal sounds. The common Red Gurnard is termed the Cuckoo, from its uttering a double note like that of our well known woodland bird; another species is named the Piper; and the grey species just alluded to, derives its appellation of Crooner from the provincial word Croon, which signifies a hollow humming sound. The voice is generally heard the instant the fish is taken into the hand, or removed from the water, but the last named species is said to utter its “crooning” as it ploughs the surface with its cleft and prickly muzzle.

Like other bottom fishes, the Gurnards live a long time out of the water.

One of the most common as well as the largest of our species is the Sapphirine Gurnard (*Trigla hirundo*, LINN.), which owes both its common and its scientific appellation to its large pecto-

* New Sporting Mag. xix. 94.

rals, which resemble wings; and are on their inner or posterior surface of a fine deep blue colour, becoming scarlet near the last ray. All the other fins are tinged with scarlet, more or less distinctly; the caudal and the first dorsal brilliantly. The two dorsals are set in a groove, bounded by two rows of strong and sharp points pointing backwards; this furrow does not extend



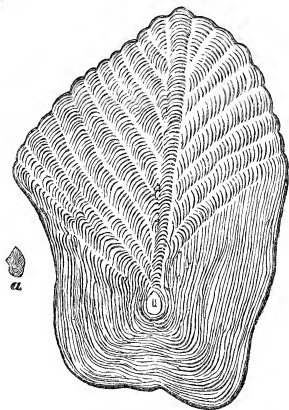
HEAD OF GURNARD.

beyond the range of the two fins either in front or behind. The bony armour which encases the head, carries several spines; the front part of the orbit of each eye is armed with three small ones; the crown plate ends in a strong broad one on each side; the gill-cover, and the fore-gill-cover each carry one, and there is another stout and strong one pointing backwards, affixed to the

bone of the shoulder. Besides which, the whole surface of the head is roughened, like a rasp, with minute knobs running in various fantastic lines and curves.

The ground colour of the upper parts is a dull olive; that of the under parts silvery white, the whole tinged with pale red; this latter hue is also distributed about in irregular mottlings, especially along the sides, on the mouth and chin, and on the finger-like pectoral rays. The eyes are large, and golden-yellow. This species attains the length of two feet or more.

The scales are very minute, more or less



SCALE OF SAPPHIRINE GURNARD (*magnified*).

a, Natural size.

angular in their outline, free from prickles: the concentric lines (*striæ*) are fine, close-set and numerous, and are interrupted by lines of clear

glassy substance, branching from a central one like the veins of a leaf; these lines correspond with indentations in the outline.

When alive in the water, the Gurnards are described as being very beautiful; the gay hues with which they are generally adorned possessing a glittering brilliancy heightened by the transparency of the element through which they are seen; more particularly in the rays of the sun, when every motion and every turn brings out some new play of colour or flash of radiance.

FAMILY V. SCIÆNADÆ.

(*Maigres.*)

The Maigres are an extensive Family, including, according to the Prince of Canino's estimate in 1831, two hundred and thirty one species; but now considered by the same Zoologist to contain but one hundred and sixty five. Of this large number, four only are found in the European seas, and two are British. The tropical parts of the Atlantic, including the West Indian Seas, are the great home of the Family; some are found in the Indian Ocean, but scarcely a single species in the Pacific.

In many respects the Maigres resemble the Perches; the operculum is armed with spines, and the pre-operculum is cut into notches like the teeth of a saw: they have strong teeth, but none in either the vomer or the palate, where the Perches are furnished with them; the muzzle is thickened and obtuse; the mouth comparatively small; the back much arched; the tail

and caudal fin are frequently inclined upwards in a slight degree: and finally, there are in general a few scales on the basal part of the dorsal or dorsals, of which fins, as in the *Percadæ*, some genera have one much lengthened but continuous, others indented by a depression more or less deep, and others completely divided into two.

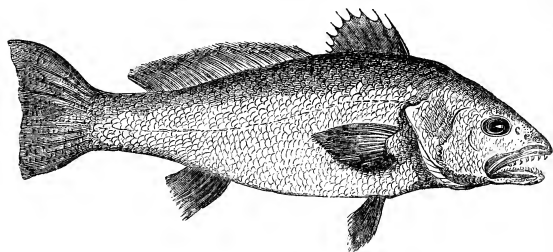
Some of the Maigres attain a great size, and some are adorned with rich colours and brilliant metallic reflections; but elegance of form is not, in general, one of their characteristics. Their flesh is highly esteemed for the table.

GENUS *SCIÆNA*. (LINN.)

The head in this genus is large, and as it were inflated, supported by cavernous bones: there are two separated dorsal fins; the spines of the anal are weak and slender, and that fin is short; the operculum terminates in one or more spines, and the pre-operculum is serrated; but the notches are apt to be effaced by age. There is a single row of strong teeth in each jaw, and a narrow line of small ones in the upper; but none on the vomer or palate: there are seven gill-rays. The whole head is clothed with scales; the two strong bones of the ears are larger than in most other fishes; the chin is not furnished with *cirri* or beards; the air-bladder is often curiously fringed. The species inhabit the Mediterranean, Atlantic, and Indian seas.

The waters that lave our own coasts occasionally produce specimens of a noble *Sciæna* which attains a length of six feet, and a bulk proportionate. It is the Maigre of the French (*Sciæna*

aquila, CUV. et VAL.), but our fishermen call it the Stone Basse, and confound it with another fish of large size, which resembles it, one of the *Percadæ*.



MAIGRE.

Mr. Yarrell describes the colour of this rare fish when quite fresh, as a uniform greyish silver, slightly inclining to brown on the back, and lightest on the belly; but the whole body assuming a much darker tint, after it has been kept for a few days. The fins are reddish brown; the first dorsal, the pectorals, and the ventrals, brighter in hue than the others. The second dorsal is twice as long as the first; the caudal is, as it were, cut off with a straight vertical edge.

Many of the *Sciænadæ* have a similar power to that already mentioned as characterizing the *Trigladæ*, that of producing vocal sounds. The Maigre's voice is compared to the purring of a cat, and it utters it not only in the air when removed from the water, but even when swimming considerably beneath the surface. When swimming in shoals, it is said the purring of the Maigre is audible from a depth of twenty fathoms.

The flesh of such specimens as have from time to time found their way to our markets has been considered good, though rather dry. In the Mediterranean, however, it has been very highly esteemed, from the earliest times, and bears the title of *King's fish*, from its reputed excellence. "It appears always to have been in great request with epicures; and as, on account of its large size, it was always sold in pieces, the fishermen of Rome were in the habit of presenting the head, which was considered the finest part, as a sort of tribute, to the three local magistrates who acted for the time as conservators of the city."

A curious story is told of the travels and adventures of a Maigre's head that was presented to the magistrates in the pontificate of Sextus X. The conservators offered it as an acceptable present to the Pope's nephew; by whom it was sent to one of the Cardinals; the latter sent it as a propitiatory offering to a banker to whom he was deeply in debt; and the banker presented it to his mistress. The interest of the story rests chiefly on the ingenuity of a dinner-hunter, who contrives to trace the savoury dish through all its migrations, and succeeds at length in obtaining an invitation to partake of the dainty.

The two hard bones that are lodged in the sides of the head, commonly known as the ear-stones, have been supposed by the vulgar, and by the scientific in former times, to possess medicinal powers. They were called colic-stones; and their virtues as curative of this disorder were supposed to be exercised by being worn round the neck, usually mounted in gold. But then it was indispensable that they should have been received as

a gift; the fact of payment having been made for them, would, it was pretended, deprive them of all their value. It is to be regretted that superstitions, equally groundless with this, are still common in this enlightened age, and in our own country; diseases being considered removable by the wearing of certain amulets or charms.

The Maigre, as a British fish, is a great rarity; the Mediterranean, especially its northern shore, is its chief resort. In its habits it is somewhat migratory; swimming in small shoals, which shift their quarters from one part of the coast to another, seldom remaining long in a place. The air-bladder is long, and tapers to a point behind; the free edge of the membrane, being cut into irregular fringes all along each side, gives it a singular appearance.

FAMILY VI. SPARIDÆ.

(*Sea-breams.*)

In form these fishes somewhat resemble those of the preceding Family, presenting a high, rather oval, vertical outline, of greater depth than thickness. They have but one dorsal, which is never clothed with scales in any degree: the operculum is not spinous, nor is the pre-operculum notched: the muzzle is not thickened, nor are the bones of the skull cavernous; the mouth is not protrusile. In addition to these negative distinctions, it may be added that the jaws are furnished with round flat grinding teeth, arranged like the stones of a pavement, and often with strong pointed canines in front; the pectoral

fins are always pointed, and the caudal forked; characters which indicate the power of swift progression through the water.

The colours of the Marine Breams are generally elegant without being showy; silvery grey or pearly white, varied occasionally with gilded or brassy reflections, and flushed with iridescent hues of rose-red, pale blue, green, and yellow, may be considered as characteristic of the Family. The fins, however, are destitute of colour, or are tinged only with dusky-brown.

From the structure of their teeth, it might be inferred that these fishes were predatory, and that their food often presented itself in a form which required great crushing and grinding force. And this is indeed the case, *crustacea* and *mollusca*, but especially the latter, affording them the main part of their sustenance; both of these classes comprising animals encased in crusts or shells, often of stone-like hardness. The common Gilt-head (*Chrysophrys aurata*, Cuv.), for example, is able to crush and grind to powder, with its powerful millstone-like teeth, the thick stony shells of the genera *Turbo*, *Buccinum*, and *Trochus*, the Periwinkles, Whelks, and Tops, of our rocky shores.

The Family is extensive, comprising, according to the latest estimate, two hundred and forty species, of which number nearly one-tenth belong to the European coasts; the rest are distributed over the shores of both hemispheres, their prevalence increasing as we approach the tropics.

In the larger Families of animals it is desirable to have subdivisions of a rank higher than that of genera; and there are always found on exami-

nation variations of structure, each possessed by a certain number of genera in common, by the selection of which such sub-division may be effected. In treating of the *Percadæ*, we briefly enumerated the subordinate groups into which that immense Family is divided; we will now indicate those into which Cuvier has distributed the *Sparidæ*.

1. The *Sparina* have the jaws set with round flat teeth like paving-stones. Eighty species belong to this group, of which sixteen are European, and five are British.

2. The *Denticina* have all the teeth conical and pointed, and the front ones hooked. This is the most important division, as regards number, though not the most typical; as it includes one hundred and twenty species, mostly tropical. Four only of these are European, of which one is marked as British, the Four-toothed Sparus, or Toothed Gilthead (*Dentex vulgaris*, Cuv.) It must, however, be reckoned among the very rarest of native animals, its claim to be so regarded resting on the authority of a single specimen. It fortunately happened that this rarity fell into the hands of Mr. Donovan, from whose "History of British Fishes," we extract the following interesting note of its powers, habits, and uses.

"A more voracious fish is scarcely known; and when we consider its ferocious inclination, and the strength of its formidable canine teeth, we must be fully sensible of the great ability it possesses in attacking other fishes, even of superior size, with advantage. It is asserted, that when taken in the fishermen's nets, it will seize upon the other fishes taken with it, and mangle

them dreadfully. Being a swift swimmer, it finds abundant prey, and soon attains to a considerable size. Willoughby observes, that small fishes of this species are rarely taken; and the same circumstance has been mentioned by later writers. During the winter it prefers deep waters; but in the spring, or about May, it quits this retreat, and approaches the entrance of great rivers, where it deposits its spawn between the crevices of stones and rocks.

“The fisheries for this kind of *Sparus* are carried on upon an extensive scale in the warmer parts of Europe. In the estuaries of Dalmatia and the Levant, the capture of this fish is an object of material consideration, both to the inhabitants generally as a wholesome and palatable food when fresh, and to the mercantile interest of those countries as an article of commerce. They prepare the fish, according to ancient custom, by cutting it in pieces, and packing it in barrels with vinegar and spices, in which state it will keep perfectly well for twelve months.”

3. The *Cantharina* contain but a single genus, in which the teeth are numerous, minute, and conical, placed in several rows; those of the outer row larger and more curved than the others. Of this limited group, England possesses one species, the Black Sea-bream (*Cantharus lineatus*, MONT.), which is by no means uncommon.

4. The *Obladina* have the foremost range of teeth compressed, placed close together, and armed with a cutting edge, which is more or less notched. This group contains only fifteen species, several of which, found in the Mediterranean, are distinguished by the metallic lustre of their

appearance, their sides presenting the likeness of silver and burnished steel, in which are imbedded longitudinal parallel bands of gold.

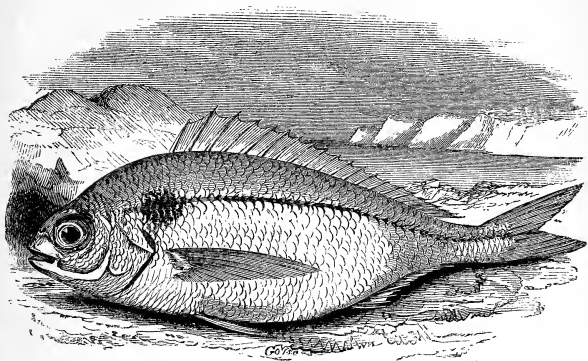
GENUS *PAGELLUS*. (Cuv.)

The present Genus belongs to the first of the sub-families, mentioned above. It is characterized by the teeth in the front half of the jaws being numerous, close-set, slender, and pointed; those in the rear being rounded molars, disposed in two or three rows, those of the outer row the most powerful. There is but a single dorsal fin, which is lengthened, and composed of both spinous and flexible rays; the pectorals are pointed; the cheeks and gill-covers are covered with scales; the form is deeper than thick; the outline of both the belly and the back is rounded.

The species of the genus *Pagellus* are common in the Mediterranean, and on the shores of the Atlantic, as far north as Denmark, beyond which they appear to be unknown. Three are found on our own coasts, two of which are rare and accidental visitants, and one is a common fish.

The Common Sea-Bream (*Pagellus centrodontus*, Cuv.) is about a foot and a half long, six inches deep, and two and a half inches thick; its form is much compressed, its outline both above and below gracefully swelling. The eye is enormous, and this gives it a peculiar appearance; the wide iris is golden or silvery. The hue of the upper parts is reddish-grey, the sides and belly pearly, with faint blue stripes running longitudinally. The dorsal and anal fins are strong and spinous, and are lodged in a singular groove; they

are brownish; the pectorals, ventrals, and caudal are pale red. There is a blackish spot at the commencement of the lateral line. The sides of

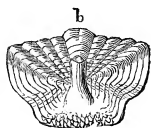
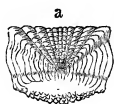


SEA-BREAM.

the head gleam in parts like frosted silver, or like the back of a looking-glass newly silvered.

The scales (see the engraving on the following page) generally approach, more or less nearly, to a square form, slightly bulging at the sides; the front, or attached end, scalloped at the edge, and waved in a radiating manner: the hinder, or free end, marked with a number of minute flexible points lying one over the other, most numerous on the scales of the belly. Those of the lateral line have the mucus-tube short but wide. *a*, represents a scale from the back; *b*, one from the lateral line; *c*, one from the belly. The silvery pigment beneath the scales does not come off with the latter when these are detached,

but remains adhering to the skin, and is with difficulty separated.



SCALES OF SEA-BREAM.

We can add our testimony to that of Mr. Yarrell, with respect to the excellency of this fish, when cooked as he prescribes.

The Sea-bream, or Gilt-head, as it is likewise called, is taken all around the shores of England, but is much more common in the British Channel than either on the east or west coast, and to the Scottish fishermen it is scarcely known. In the London market it is by no means uncommon, in the summer and autumn months. During the prevalence of frosty weather it retreats into deep water, where, as Mr. Yarrell informs us, on the au-

thority of Mr. Couch, it deposits its spawn at the commencement of winter. The young fry, which go by the name of Chads, are about an inch in length in January; by the middle of summer they are five or six inches long, and attain half their full size, or about nine inches, by the end of their first year. The fry of half a year old congregate in immense numbers around the shores in summer, and are caught by anglers with the utmost ease in harbours and from the rocks, since they bite eagerly at any bait. Their food, both in the young and the adult state, comprises both animal and vegetable substances: Mr.

Couch says, "They devour the green species of sea-weeds, which they bite from the rocks, and for bruising which their teeth are well suited, as are their long and capacious intestines for digesting it." The great strength of their jaws and teeth, however, bespeaks heavier labour assigned to these organs than that of bruising sea-weeds. Colonel Montagu found in the stomach of one, besides some small Sand-launce, the limbs of crabs, and fragments of shells. And in the stomach of one which we lately examined, there were found numbers of bivalve shells, all of one kind, a small grey *Tellina*, some of which were perfect, but most were broken, crushed, and ground down to a coarse powder by the action of the strong molars.

"In its general habits," says the excellent naturalist, to whom we owe so much of our knowledge of the fishes of the west of England, "the Sea-Bream might be considered a solitary fish; as when they most abound, the assemblage is formed commonly for no other purpose than the pursuit of food. Yet there are exceptions to this; and fishermen inform me of instances in which multitudes are seen congregated at the surface, moving slowly along as if engaged in some important expedition. This happens most frequently over rocky ground in deep water."*

* Cited in Yarrell's British Fishes, i. 125.

FAMILY VII. MÆNADÆ.

(Mendoles.)

With much in their form and characters that resemble the preceding Family of the *Sparidæ*, the *Mænadæ* differ from them in the extreme extensibility, and retractibility of the upper jaw, a peculiarity dependent on the length of the intermaxillary pedicels, which withdraw between the orbits of the eyes. They have teeth in the jaws, which are very fine and close set, resembling the pile of velvet; in general, the palate is toothless. The body is furnished with scales, some of which, very small and delicate, often, but not always, extend upon the dorsal fin; the ventrals are placed beneath the pectorals. Their air-bladder is large, simple, and rounded in front; commonly divided posteriorly into two long horns, which penetrate into the muscles of the tail, on each side of the internal spines of the anal fin.

The four genera which compose this Family, comprising, according to the Prince of Canino, sixty-one species, are thus distributed. *Mæna* is confined to the Mediterranean; *Smaris* inhabits the same sea, but less exclusively, a few species being found in the East and in the West Indies; *Cæzio* is confined to the Indian Ocean and its gulfs; and *Gerres* spreads itself over all the tropical seas. The Family is of little importance to man; the Common Mendole (*Mæna vulgaris*, Cuv.) of the Mediterranean, is considered so utterly worthless, that its name in Venice is a

proverb of vileness, and has passed into the vocabulary of insult. A West Indian species of *Gerres* is remarkable for the rapidity with which it decomposes, the flesh becoming soft almost immediately after it is dead. Another species of this genus, however (*Gerres rhombeus*, Cuv.) is esteemed one of the best fishes in Jamaica, where it goes by the name of Stone Basse. This little fish is reported by Mr. Couch to visit the coast of Cornwall, arriving there in considerable numbers, accompanying pieces of floating timber covered with Barnacles. Hence it is probable that these shelled Cirripedes form the favourite food of the *Gerres*, though M. Cuvier says that he has never found in its stomach anything but the remains of very minute fishes. The species of the genus *Smaris*, which we shall select to illustrate the Family, are sufficiently esteemed to be the subjects of fisheries of some importance, on the European coasts of the Mediterranean.

GENUS *SMARIS* (Cuv.).

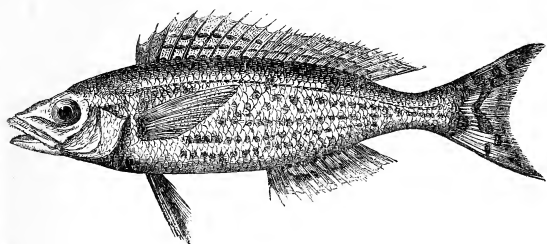
The general form is that of a Herring, but rather more lengthened in proportion to the breadth. The mouth is very protrusile; the jaws are furnished with fine slender teeth, but the vomer is toothless. The fins are destitute of scales, except some on the sides of the ventrals; the scales between the ventrals are elongated.

The fishes are called Picarels by the French, but on the coasts and among the isles of Greece they retain their ancient name, slightly modified, *marida* being only a corruption of *Σμαρίς*, the term by which these little fishes were designated

in ancient times. They frequent the shallows of the shore, especially where the bottom is muddy and weedy; hiding among the marine vegetation, like birds among the bushes, and preying upon small fishes, and the feeblers *crustacea* and *mollusca*. One species, the commonest of all (*Smaris vulgaris*, Cuv.), abounds so much at Iviça, one of the Balearic Isles, that according to M. de Laroche, it forms more than half of the whole produce of the fisheries of that island. It bears here the name of *jarret*. Rondelet tells us that after having been salted, the Picarel is exposed to the action of the air, to make a sort of *garum*, or sauce. It has been supposed that the appellation of Picarel, was derived from *picoter*, to prick or stimulate, alluding to the pungent taste of the sauce so prepared. But M. Duhamel denies the correctness of this; for, according to the observations of a correspondent of his, from Antibes, the Picarel is here confounded with a small species of the Herring genus, called there *pyraie*. He asserts that it is this fish, and not the true Picarel, which is made into sauce.

The most beautiful species of the genus is that called by the fishermen of Nice, the Kingfisher of the Sea (*Smaris alcedo*, Cuv.), in allusion to its brilliant tints. This lovely little fish does not commonly exceed seven inches in length. The upper parts are grey with golden reflections; the sides are silvery; the belly tinged with yellowish-green. The head and the gill-covers are marked with blue dashes; the sides are ornamented with four longitudinal lines of spots, of the most radiant ultramarine blue; and on the belly there are six similar rows of a paler tint.

The dorsal, anal, and caudal fins are of a beautiful yellow, spotted with blue; the pectorals are reddish; the ventrals are pale blue, mottled with



KINGFISHER SMARIS.

reddish, and bordered with yellow. The Mediterranean coast of France is the locality frequented by this brilliant species, of whose distinctive natural history nothing seems to be recorded.

FAMILY VIII. CHÆTODONTIDÆ.

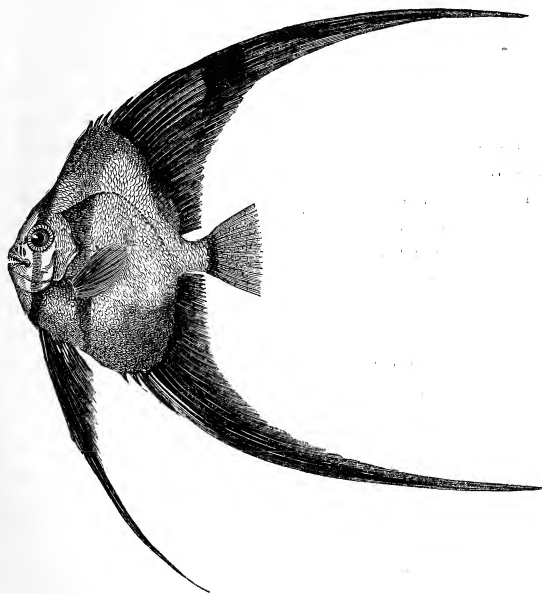
(*Chætodons*.)

We arrive now at a Family of Spinous-finned fishes, particularly interesting on account of the peculiarities of form and of colour that commonly distinguish them, but quite unknown to the cold waters of our northern clime. Cuvier assigned to the Family the appellation of *Squamipennes*, which is sufficiently expressive of one of their prominent characteristics; the soft, and frequently even the spinous parts of their dorsal and anal fins, being fleshy, and covered with scales,

by which they are encrusted like the rest of the body; and thus their origin is not readily distinguished. Their form is generally exceedingly thin, but being greatly dilated in the vertical direction, and much shortened longitudinally, their appearance, at least in the typical genera, approaches to that of a piece of money, more or less nearly, that is, round and thin. The teeth are fine, long, and slender, resembling hairs collected in several close rows, like the bristles of a brush. The name *Chætodon*, by which Linnæus designated the whole Family, signifies *bristle-tooth*, and describes this peculiarity of dentition. The mouth is small, and usually projects in a prominent and pointed snout. The fins are usually much developed, particularly the dorsal and anal, the former of which sometimes terminates in one or more free filaments of great length and slenderness, as in the genera *Heniochus* and *Zanclus*, for example. In the genus *Psettus*, the body is so drawn out above and below, and the dorsal and anal fins are so pointed and hooked, that the fish when laid on its side, bears no slight resemblance to the figure of a bat with expanded wings. *Platax* has these fins still more enormously lengthened and pointed, as are, in this genus, the ventrals also.

The beauty of these fishes, which are generally of very small size, never fails to evoke the admiration of those who, with eyes opened to the wonderful works of God, visit the shores of the tropical seas. "In the Chætodons," observes an eloquent naturalist, "the seas of the torrid zone possess animals not less ornamented by the hand of Nature [rather by the hand of Nature's Lord],

than the countries whose shores are bathed by these waters. If the hot countries of Africa and America have, among their feathered tribes, their souimangas, their humming-birds, their cotingas, and their tanagers, the intermediate seas support



PLATAX.

myriads of the finny race still more brilliant, whose scales reflect the tints of metals and precious stones, heightened in effect by spots and bands of a more sombre hue, distributed with a symmetry and variety equally admirable. The

genus *Chætodon* has many species in which Nature appears almost to have disported herself by clothing them in the most gaudy manner. Rose, purple, azure, and velvety black, are distributed along the surface of their bodies, in stripes, rings, and ocellated spots on a silver ground; nor are the beauties of these fishes lost to man, or confined to the depths of ocean. They are small, and usually remain near the shore, between the rocks, where there is but little water. Here they are incessantly sporting in the sun-beams, as if for the purpose of displaying the ornaments they have received from Nature.”*

In almost all the members of this numerous Family, the muzzle projects into a prominent snout; and in some of the genera, as *Zanclus*, and more especially *Chelmon*, it is produced into a long narrow tube. In the latter genus, a very curious instinct and endowment attend this peculiarity of structure. In the year 1763, Dr. Schlosser presented to the Royal Society a specimen of the East Indian species, now known as *Chelmon rostratus*, with some information on its singular habits, which had been given him by Mr. Hommel, governor of the hospital at Batavia, in Java. The fish “frequents the shores and sides of the sea and rivers in search of food; when it spies a fly sitting on the plants that grow in shallow water, it swims on to [within] the distance of four, five, or six feet; and then, with a surprising dexterity, it ejects out of its tubular mouth, a single drop of water, which never fails striking the fly into the sea, when it soon becomes its prey.

* Griffith’s Animal Kingdom, x. 322.

“The relation of this uncommon action of this cunning fish, raised the Governor’s curiosity; though it came well attested, yet he was determined, if possible, to be convinced of the truth by ocular demonstration. For that purpose he ordered a large wide tub to be filled with seawater, then had some of these fish caught, and put into it, which was changed every other day. In a while they seemed reconciled to their confinement; then he determined to try the experiment.

“A slender stick, with a fly pinned on at its end, was placed in such a direction on the side of the vessel as the fish could strike it. It was with inexpressible delight that he daily saw these fish exercising their skill in shooting at the fly with an amazing velocity, and never missed their mark.” *

As this beautiful little trait of instinctive skill has been often noticed, we have thought that our readers might like to have the very words in which it was originally communicated to the world, and have, therefore, cited the Memoir of Dr. Schlosser. It has since been witnessed by M. Reinwardt, who repeated the facts to M. Valenciennes. According to this naturalist, the Chinese inhabitants of Java are fond of keeping these little fishes in vessels of glass and porcelain for their amusement; frequently suspending an insect by a thread, or fastening it to a stick above the margins.

We think it not improbable that several other species of this Family, especially those in which the muzzle is produced, would be found to possess, and to make use of a similar instinct, if

* Phil. Trans. 1764, vol. liv. p. 89.

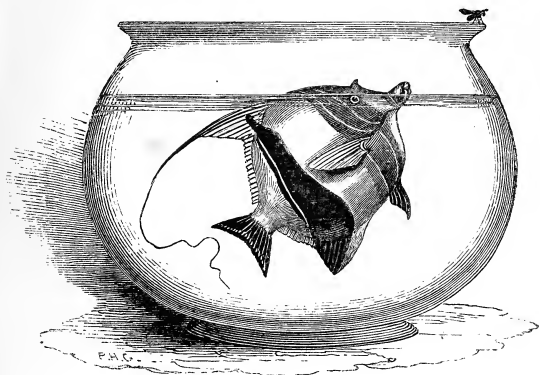
experiments were instituted to ascertain the fact. We know that it is the case with one species inhabiting the same seas, but so different in its structure as to form a genus by itself, the Archer of Java (*Toxotes jaculator*, Cuv.). The mouth is not at all tubular, nor is it produced into a snout, the gape is rather wide, and the lower jaw is longer than the upper, a mouth totally different from that of *Chelmon*, yet it has exactly the same habit. "It well merits," observe MM. Cuvier and Valenciennes, "the name of Archer, by its singular industry. It knows how to shoot drops of water to a great height, three feet and upwards, and to reach, almost without failure, the insects, or other minute animals, which creep on the aquatic plants, or even on those that grow upon the shore. The inhabitants of many countries of the Indies, especially the Chinese of Java, rear it in their houses to amuse themselves with its manœuvres, and offer it ants or flies on threads and sticks within its reach. We have received from Batavia an individual, the stomach of which was entirely filled with ants."*

It is probable that this is by no means the *constant* habit of procuring food even with this species, but that they more commonly content themselves with the minute animals which, like themselves, inhabit the sea-water. The learned naturalists just quoted, found, on dissecting a second specimen of the *Toxotes*, that the stomach was filled with small *crustacea*.† We have watched the proceedings of a brilliant little Chætodon on the shores of Jamaica (*Ch. striatus*),—a tiny creature, no larger than a five-shilling

* Hist. des Poissons, vii. 310.

† Ibid. p. 321.

piece, marked with alternate bands of black and rich yellow,—as it played about the stones and crevices of the rocks in shallow water, apparently picking its minute prey from their sides. It has the curious and apparently unaccountable habit of butting with the head against the stones, many times in quick succession, with such force as to



CHÆTODON IN A VASE.

rebound for several inches. This same propensity has been noticed in another part of the world; M. Freycinet, in his *Voyage round the World*, records, that when wading over the coral reef encircling the island of Guam, in the Indian Archipelago, in search of *mollusca*, he was assailed by a small Chætodon, not bigger than his hand; *it butted at his hand*, and pertinaciously refused to be driven away. In the former case it might, perhaps, be presumed that the fish was collecting some object or other, animal or vegetable,

desirable to it, in these repeated strokes ; but what could the naked hand of the worthy naturalist yield in the way of food ? We must be content to reckon the action among the thousands which we observe in animals, to which our habits, instincts, and reason, afford us no clue whatever.

The colours of these little fishes, we have already said, are beautiful, and the *style* of coloration is not less striking than the tints themselves. A very common combination in the group is a ground colour of silvery white, frequently tinged with rose or yellow, on which are drawn narrow parallel lines of vivid colour, meeting at a sharp angle on the lateral line, frequently varied by ocellated spots, and transverse bands of black across the body and fins. Not rarely the ground colour is golden yellow, more or less intense, crossed by black bands.

The species are very numerous ; one hundred and ninety-four are enumerated by the Prince of Canino as belonging to the Family, of which one hundred and fifty are of the typical form. They swarm in the warm seas, all round the globe, but, as far as we know, only in the vicinity of land. The reefs of coral with which the shores, both of the islands and continents in the equatorial regions, are girt, are the favourite resorts of these painted little fishes. Not a single species of the *typical* Chætodons is found so far north as Europe ; there is, however, one belonging to the more aberrant genera, closely allied to the Archer (*Toxotes*), whose occasional capture on these coasts warrants its enumeration among British Fishes : with a notice of its generic and specific characters we close our account of the Family.

GENUS *BRAMA*. (Cuv.)

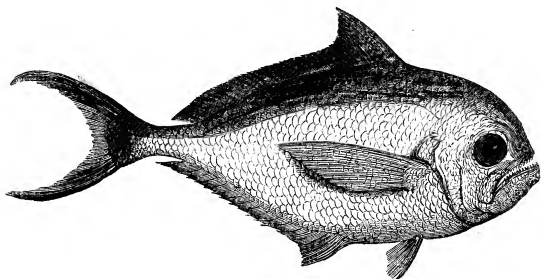
In this genus the body is compressed and deep, but less so than in the typical genera of the Family; viewed laterally the form is ovate, becoming very narrow at the tail; the forehead nearly vertical. There is but one dorsal, which is long, with the fore part high and pointed; the anal is similarly shaped; the membranes of both these fins are partially covered with scales: the caudal is very high and formed like a narrow crescent. The jaws and palate are furnished with slender teeth, curved inwards; two in front are sometimes more lengthened than the rest.

There is much in the form of this fish, in the shape and position of its fins, and particularly in its high crescentic caudal, as well as in its rich metallic hues, that resembles the pelagic forms of the great Mackerel Family, with which Prince Bonaparte associates it. The scales on the vertical fins induced Cuvier and Yarrell to place it among the Chætodons. Other naturalists, as Pennant, Donovan, and Montagu, have considered it as a *Sparus*; and the common names of the only species, Ray's Gilthead, and Ray's Sea-Bream, indicate such a degree of resemblance to the *Sparidæ* as warrants their opinion. We may safely consider the genus as closely linking together these three important Families.

The single species just named, (*Brama Raii*, Cuv.), itself constituting the whole genus, derives its specific appellation from our illustrious countryman, John Ray, whose name was conferred on it by his friend and fellow-labourer, Willoughby.

Mr. Yarrell describes it as not particularly rare on our shores, enumerating the Frith of Clyde, the coast of Argyle, the Frith of Forth, and St. Andrews, as localities in Scotland, where it has been taken; and, in England, Berwick Bay, the mouth of the Tees, the coast of Devon, and that of Cornwall; as well as at Swansea in Wales, and at Belfast in Ireland. It occurs also all along the western shores of Europe, as far north as Norway, and is abundant in the Mediterranean.

Ray's Sea-Bream attains a length of thirty



RAY'S SEA-BREAM.

inches, and a height, including the fins, of about half as much. The eye is large, with the iris darker than the pupil; the back is very dark blue; the upper part of the head coppery-brown, with a band of blue across the forehead; the sides and belly are silvery, mingled with coppery and lake-pink hues on the upper parts, and marked with irregular dusky stripes on the sides; the dorsal and anal fins, being scaled, shine like burnished silver.

Nothing is recorded of the habits of this fish; but its flesh is said to be as excellent, as its appearance is brilliant.

FAMILY IX. SCOMBRIDÆ.

(*Mackerels.*)

This is a very important Family, not only on account of the number of species included in it, which is very great, but also because of the value of many of them as food; the great abundance of some, and their gregarious habits, rendering them suitable subjects for extensive fisheries. The body is commonly ovate, with a tendency to compression, sometimes becoming very thin and high; the scales are remarkably small, sometimes almost invisible; the bones of the head have only the ordinary development, and the gill-covers are not armed with spinous projections. The body is smooth, but the back is often armed with prickles; the fins are strongly developed, and indicate the power of swimming to be possessed in a high degree; the pectorals are generally long, narrow, and pointed; there are two dorsals, the first containing bony rays, which are often greatly lengthened; the second composed of soft rays, and frequently divided into a number of small finlets, as is also the anal; the caudal is in general greatly produced vertically, and deeply forked.

The Family before us is one of the most extensive in the whole Class; in this respect it is exceeded only by the Carps and the Perches, and just equalled by the Wrasses. In Prince Bona-

parte's recent Conspectus, four hundred and nineteen species are assigned to the Family, as we shall consider it, including the Sword-fishes and the Dorados, of which that zoologist constitutes separate Families. The whole of this vast assemblage are marine, (with the exception of one or two obscure species inhabiting the Asiatic rivers), and many of them properly pelagic, roving the ocean far from land. They are found in all seas.

We shall enumerate the characters of the subordinate groups, or sub-families, into which this great host is distributed, and notice a few particulars of the most interesting species. These groups are six in number.

1. *Scombrina*. The body is rather lengthened than oval, smooth, clothed with minute scales; two dorsal fins are present, the second as well as the anal cut, for the greater part of its length, into small equidistant finlets, reaching to the caudal; the caudal is very high and deeply forked; the jaws are nearly equal in length, not furnished with fleshy lips. Between one sixth and one seventh of the total number of species in the Family are contained in this section, which are scattered over the whole ocean. Besides our beautiful and valuable Mackerel, of which we shall presently speak, we find placed here the Genus *Thynnus*, (Cuv.) including the swift, vigorous, warm-blooded Bonitos of the tropics, the pursuers of the little Flying-fishes, and the noble Tunny of the Mediterranean. Specimens of all these are occasionally taken on the British shores.

The flesh of the Tunny (*Thynnus vulgaris*, Cuv.) is firm, wholesome, and highly esteemed; and as the fish attains the length of from fifteen

•

to eighteen feet and a correspondent bulk, and usually swims in large shoals, ranging near the shore, the pursuit of the species forms one of the most valuable fisheries of the south of Europe. The circumstances attending its capture, as recorded by MM. Cuvier and Valenciennes, are so interesting that we make no apology for presenting them to our readers. These fishes are taken in two principal modes. In the one, whenever a sentinel, posted on an eminence for the purpose, has indicated to the fishermen that the Tunnies are coming, and has shown the direction of their approach, a number of boats set off under the command of a captain, and having arranged themselves in a semicircle, unite their nets to form a common enclosure. The Tunnies, alarmed, huddle together in closer array, while the line of nets being rapidly lengthened by additions at each end, gradually drives the shoal more and more in shore. At length, when the fishes have been forced so near the land, that the water is only a few fathoms deep, the fishermen cast a large net terminating in a lengthened conical pocket; this they presently haul on shore inclosing the whole shoal of fishes. The largest are killed while in the water, with poles and gaffs, the small ones are carried up to the beach in the fishermen's arms. Fifteen tons' weight of Tunnies are sometimes taken at a single haul in this manner, on the coast of Languedoc.

The other mode of fishing is with a complex apparatus of nets, called by the French the *madraque*, by the Italians, the *tonnaro*. It is an expensive affair, consisting of a double row of large long nets, made to hang vertically in the water by

means of corks along the top, and weights along the bottom: these are moored with anchors so as to form an enclosure parallel to the shore, but at some distance from it, extending sometimes to the length of a mile. The long narrow enclosure is then formed into chambers, by means of cross nets hung from side to side in a similar manner, but all communicating with each other by narrow openings, or, as we may call them, doors. About the middle of the line a net is hung transversely from the inner side reaching to the shore, and thus closing the passage.

It is the habit of the Tunnies to swim very close to the land; therefore, when in their roving, they come to this part of the coast, they pass between the nets and the shore, until they find their further way stopped by the long net last mentioned, hanging right across their course. Ranging along by its side in the seaward direction, they find the opening leading into the first chamber of the enclosure; they enter it, and find themselves surrounded by nets, except at one point, through which they enter into the second chamber. Precautions are taken to prevent their return, and they are driven from one compartment to another, until they reach the last, which is called the chamber of death. Beneath this, near the bottom, there is a net stretched horizontally, which can be elevated to any level at pleasure. The fishermen, having assembled in boats, bring the Tunnies, by means of this horizontal net, to the surface, and the slaughter commences. The fishes are killed with poles, boat-hooks, and similar weapons.

The whole proceeding forms an imposing spec-

tacle, and never fails to attract a great number of interested spectators; while it is at the same time one of the principal amusements of the more opulent inhabitants of Sicily, and one of the most important branches of the commerce of that beautiful island. Louis XIII., who was present at a tunny-capture of this kind at Marseilles, was often afterwards heard to declare that nothing in his whole progress through the southern parts of his dominions had so entertained him as the *Madraque* of Morgion.

2. *Xiphiana*. These have most of the characters of the preceding group, but the bones of the upper jaw are greatly lengthened, so as to form a long straight sword, with sharp edges. The gills are not divided into a multitude of filaments, resembling a comb, as in most other fishes, but consist of two large parallel *laminæ* on each side, with a netted surface. The ventral fins are either wanting, or consist of one or two inflexible bones. There is, properly speaking, only one dorsal, which is high and long; but the middle part becomes so worn away in the course of growth, that only the two extremities are left in old specimens, looking like two dorsals. Six species are enumerated in this group, constituting no fewer than five genera; they are all fishes of large size, familiarly known as Sword-fishes, and range the oceans and great inland seas, all round the globe, from the equator to the polar regions.

One species of this sub-family, the common Sword-fish, (*Xiphias gladius*, LINN.) has been rather frequently caught on our own coasts; and there is an instance on record of a blow from the formidable weapon of one having been fatal to

a man while bathing in the Severn. It is by no means an uncommon thing for this great and powerful fish to bury his weapon in the timbers of a ship, and perhaps some of the cases in which ships never heard of, and supposed to have gone down in stress of weather, may have been owing to an accident of this sort. It is probable, however, that such an encounter is, in most cases, fatal to the fish, for to pull out the sword from nine inches or more of solid timber, would need a greater effort than to drive it in, and would require that force to be exerted under most disadvantageous conditions. For to give the blow, the animal is able to bring an impetus acquired by the exercise of his utmost powers of swimming, but to dislodge his firmly inserted brand, he must exert a backward force, for which his fins are but feebly adapted, and without the advantage of any accumulated impetus. How great a force is required to perform the terrible feat we learn from the report of the shipwrights, who examined the bottom of H.M.S. Leopard, which, on her return from a tropical cruise in 1725, was found to have the weapon of a Sword-fish imbedded in her timbers. They declared that to drive an iron pin of the same size and form to the same depth, it would require eight or nine strokes of a hammer of twenty-eight pounds weight. How mighty then must have been the muscular power of this fish, which had been able to perform such a feat at a single stroke! What adds to our admiration is that from the position in which the sword had penetrated, from the stern towards the bow, it was evident that the fish had followed the ship when under sail; so that the whole way of the

vessel through the water must be deducted from the force exerted by the powerful animal. The weapon in this case had penetrated through one inch of sheathing, three inches of planking, and four inches and a half of the solid timber.

The Sword-fish is the furious enemy of the Whales, including the northern species and the Cachalot; and many accounts relate the rage and energy with which the armed warrior of the seas attacks his gigantic foe, and seeks to bury his weapon in his mighty sides. And in this animosity a motive has been sought for the suicidal assaults already mentioned, the Sword-fish mistaking the hull of the ship, a huge dark body moving through the water, for his enemy, and darting upon it with blind indiscriminating fury. It may be so: but Cuvier mentions a little fact, with which these attacks may not be unconnected. "Notwithstanding its formidable weapon, its great strength, and its almost incredible celerity, a small *crustaceous animal* penetrates the flesh of the Sword-fish, and sometimes so torments it that *it dashes itself on the shore* with mortal violence."

3. *Centronotina*. The form is oblong, or sometimes lengthened and slender; the fore part of the dorsal is superseded by a number of small free spines; the ventrals are present and perfect; the body is covered with very small scales. Seventy species are reckoned to belong to this group, which ranges over all seas. The most worthy of notice is the beautiful little Pilot-fish (*Naucrates ductor*, LINN.), so called because of its constant attendance on Sharks, as well as on ships, a propensity as unaccountable as it is interesting. The fact is indubitable; we have ourselves witnessed

it in both of its phases. In the warmer parts of the Atlantic we have frequently watched with delight, some two or three of these little fishes, playing under the stern from day to day, attending the ship on her course through many degrees of longitude; always conspicuous in their livery of dark blue bands across a silvery-grey ground, as they turned hither and thither, and hurried to and fro in the "dead-water" between the rudder and the ship's counter, sometimes shooting out a yard or two after some swimming atom, and then darting back to the favourite corner. The singularly unequal friendship subsisting between this little fish and the terrible White Shark we have also many times observed, and never without astonishment and admiration. Once, during a long calm, in a voyage to the Gulf of Mexico, as well as both before and after its prevalence, these hateful fishes were perpetually stealing round the ship; but we do not recollect ever having seen a Shark of any considerable size, without one or more of these Pilots attending him. This little creature generally keeps his station just over the head of the Shark, but sometimes over one of the pectoral fins, within an inch or two of his body, turning when he turns, stopping when he stops, and never leaving him, except to swim a-head to examine some bait. Having examined it, he instantly returns and resumes his place. It would really appear as if some communication took place between them, for the Shark, who before seemed quite unaware of the proximity of any food, on the return of the Pilot-fish instantly quickens his motion and bustles towards it. But an instance still more

conclusive is recorded in Griffith's Cuvier, furnished by Colonel Hamilton Smith, and confirmed by his own observations. "Captain Richards, R.N., during his last station in the Mediterranean, saw on a fine day a Blue Shark, which followed the ship, attracted perhaps by a corpse which had been committed to the waves. After some time a shark-hook, baited with pork, was flung out. The Shark, attended by four Pilot-fish, repeatedly approached the bait; and every time that he did so, one of the Pilots preceding him was distinctly seen from the taffrail of the ship to run his snout against the side of the Shark's head to turn it away. After some farther play, the fish swam off in the wake of the vessel, his dorsal fin being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and before the Pilot-fish could overtake him and interpose, snapped at the bait and was taken. In hoisting him up, one of the Pilots was observed to cling to his side until he was half above water, when it fell off. All the Pilot-fishes then swam about a while, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Colonel H. Smith has himself witnessed, with intense curiosity, an event in all respects precisely similar."*

Not a few instances are on record of Pilot-fishes having accompanied vessels all the way from the Mediterranean, and even from its remotest parts, until they dropped anchor in a

* Animal Kingdom, vol. x. p. 636.

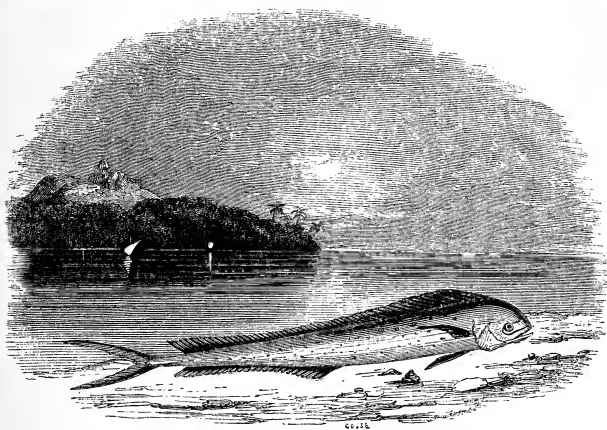
British harbour. Five or six such cases are mentioned by Mr. Yarrell. On these visits of courtesy seems to depend the claim of the species to a place among British Fishes.

4. *Vomerina*. A few genera, rather numerous in species, (which amount, according to Prince Bonaparte, to sixty-five), are grouped together here, distinguished by having the body short, very deep, and very thin; a smooth, satiny skin, destitute of any apparent scales; the rays of the dorsal, anal, and ventrals, often prolonged into slender filaments. The species are chiefly found in the tropical seas, and none are recorded as British, or even European.

5. *Zeina*. The form in this group is thin, deep, and short, as in the preceding; but the mouth is greatly projectile, and furnished with numerous small teeth. The dorsal is single (in most of the genera) and is not preceded by any free spines. There are about forty species, of which three are marked as British. One of these is the John Doree, (*Zeus faber*, LINN.) eminent in all ages for the flavour of its flesh. The ancients honoured it with the name of the supreme demon in their mythology, (*Zeûs*, Jupiter), in token of their estimation of it; and in modern times, the prince of epicures, Quin, disdained not to make a journey from Bath to Plymouth for the sole purpose of eating it in perfection. Medieval superstition assigns other honours to this fish: there is a round spot of black on each side in the middle of its yellow body, which is accounted for by the legend which makes the Doree the fish caught by the apostle Peter to pay the tribute shekel, or by the rival story, equally true,

that it was caught by St. Christopher, while wading through an arm of the sea.

6. *Coryphænina*. Here also the body is greatly compressed, but it is also lengthened; the body is either destitute of scales, or clothed with such as are very minute; the head forms a sharp edge along its summit; the mouth is small, not protrusile. There is one dorsal extending nearly all along the



CORYPHENE.

back, and furnished throughout with flexible rays; the ventrals are small, or absent. Sixty-seven species are enumerated in this sub-family, chiefly inhabitants of the warmer parts of the ocean, but a beautiful one (*Coryphæna hippuris*, LINN.) is found in the Mediterranean. Its beauty is extraordinary, especially when beheld in the activity and brilliancy of life, glittering in the crystal

waters of the southern seas, and flinging back the blaze of a tropical sun. Its long dorsal is sky-blue, with the rays gold coloured; its caudal green; the body is green on the upper parts, mottled with orange, and the under parts shine with the lustre of burnished silver, divided from the green hue by a yellow lateral line.

In the tropical parts of the Atlantic we have been familiar with a species akin to this, but apparently distinct from it. In those waters, especially in the calms that so frequently prevail where the trade-wind ceases, the Coryphenes, or as seamen incorrectly name them, *Dolphins*, are very common. One is never weary of admiring their beauty. Their form is deep, but thin and somewhat flattened: and their sides are of brilliant pearly white, like polished silver. In small companies of five or six, they usually appear and play around and beneath the ship, sometimes close to the surface, and sometimes at such a depth that the eye can but dimly discern their shadowy outline. When playing at an inconsiderable depth, in their turnings hither and thither, the rays of the sun, reflected from their polished sides, as one or the other is exposed to the light, flash out in sudden gleams, or are interrupted, in a very striking manner. Night and day these interesting creatures are sporting about, apparently insusceptible of weariness. Their motion is very rapid, when their powers are put forth, as in pursuit of the timid little Flying-fish.

In all books of Natural History we see accounts of the fleeting hues which play over the body of the Coryphene in the agonies of death;

and these are commonly described as equalled in delicacy, brilliancy, and variety only by the colours of the rainbow. "The changing tints of a dying Dolphin," are in every mouth, as a current proverbial phrase. We have had the opportunity of witnessing the death of an Atlantic Coryphene, in which the phenomena displayed were of quite another kind than we had supposed. We had expected that, as it died, opaline flashes would fleet over the skin; but what really occurred was this: when brought out of the water it was silvery-grey, with pearly reflections, but in a few minutes after it had lain on deck, the whole body *suddenly* changed to a brilliant green, (a permanent, not an iridescent colour,) the back dark, the belly yellower, almost like gold, with blue spots; *this was the only change*, except that the hue became more dingy after death. Alive, and in their native element, as we have already observed, these fishes are very beautiful; generally appearing (judging from our own observation) in parties of five or six, they play around the ship, sometimes at the surface, and then far down in the clear depths below. When they turn in the water, their backs are dark one moment, and the next gleam like polished silver, or mother-of pearl.

To this group belongs also the Genus *Pteraclis*, remarkable for the great height of the dorsal and anal fins, as represented on page 55 of this volume.

Such are the groups of the great Mackerel Family, one of the most numerous in species, and most varied in form of the whole Class, and comprising some of the most beautiful of all fishes,

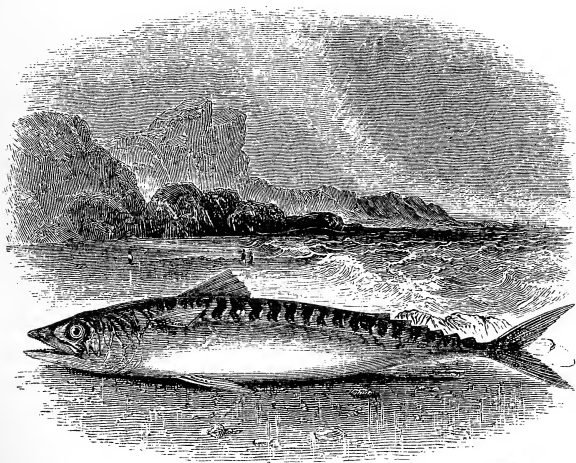
whether as regards compact gracefulness of form, brilliancy and diversity of colours, or the elegance with which the different hues are arranged, harmonized, or contrasted. Perhaps the whole of the great Class of vertebrate animals which form the subject of this volume, cannot show a more perfect example of elegance and beauty than the Common Mackerel, whose history we shall now proceed to delineate in detail.

GENUS *SCOMBER*. (LINN.)

The distinguishing characters of the Mackerels proper are the following: The body is spindle-shaped, or swelling in the middle and gracefully tapering to each extremity; it is uniformly covered with small smooth scales, which do not extend to the fins. The extremity of the tail is furnished with two slight ridges on each side. There are two dorsals, remote from each other, the second of which, as well as the anal, is followed by a number of small triangular finlets; the caudal is high, narrow, and crescent-shaped. The gill-covers are not armed with either spines or denticulations; the gill-rays are seven; there is a single row of small conical teeth in each jaw.

Two, if not three species of this restricted genus are taken on the shores of Britain, of which the most abundant is the well-known and valuable Common Mackerel, (*Scomber scomber*, LINN.), to the beauty of which we have already alluded. It is about fifteen inches in length; the colour of the upper parts is of a brilliant green, varied with rich blue, and crossed by a great number of narrow black bands; these are

nearly straight in the male, but elegantly waved in the female. The sides and belly are pearly, with iridescent reflections. The transverse bands of the back have given rise to the name by which this beautiful fish is known. *Mackerel* (*maquereau* in French) is considered as having been derived from the Latin word *macularius* spotted.



MACKEREL.

The sudden appearance of immense hosts of fishes on the coast at regular periods, by which their pursuit and capture in sufficient numbers to constitute fisheries, are facilitated, was formerly little understood; and the older writers had recourse to the hypothesis of long annual migrations of certain species, to account for their

appearance and disappearance on the various parts of the coast of Europe. Thus Anderson, writing of the Mackerel, says that it "passes the winter in the north; towards the spring it approaches Iceland, Scotland, and Ireland, and enters the Atlantic Ocean, whence one column passes along the coast of Portugal and Spain, and enters the Mediterranean, while the other turns into the British Channel, and appears there in May, on the coasts of France and England; and from thence passes in June along those of Holland and Friesland. This second column having reached in July the coasts of Jutland, detaches a division, which, making the tour of that peninsula, enters the Baltic Sea; and the remainder, passing along the coast of Norway, return to the north."

Facts, however, do not agree with these statements; the appearance of this fish in shoals varies in the times of its occurrence, certainly, at different points on the coast; but does not at all follow the line of succession which a migration would involve. Thus the Mackerel appears on the Cornish shores often in March; on the coasts of Hampshire and Sussex, at the same time, and on the latter frequently in February; while in the bays of Devonshire, though an intermediate locality, they are not plentiful till June. On the French side of the channel, they appear later about Havre and Dieppe than at Dunquerque; which is the reverse of the order followed on our own south-eastern coasts, for little is done in the Mackerel fishery in Suffolk and Norfolk before the latter half of May, two or three months after it has begun on the coast of Sussex and Kent. In Scotland their occurrence is considerably later

still; as they are said to appear among the Orkney Islands, and in the Frith of Forth about the end of July or the beginning of August.

It is now generally believed that the whole of the phenomena of the seasonal appearance and disappearance of fishes may be accounted for on the principle, now pretty well ascertained, that the vivification of the spawn requires its deposition in situations where the sun's rays can have ready access to it. But this would be impossible if it were deposited on the bottom in considerable depths of water; and hence, these animals have been endowed with instincts, which impel them at the proper period, to resort to the shallows of the coast, where the incumbent stratum of water is not too great to allow the solar light and heat to penetrate to the sand and gravel of the bottom, among which the ova are to find their resting-place.

On this interesting subject we are glad to quote the opinions of one of the most illustrious of ichthyologists. "It does not appear," observes Mr. Yarrell, "to have been sufficiently considered, that, inhabiting a medium, which varied but little either in its temperature or productions, locally,—fishes are removed beyond the influence of the two principal causes which make a temporary change of situation necessary. Independently of the difficulty of tracing the course pursued through so vast an expanse of water, the order of the appearance of the fish at different places on the shores of the temperate and southern parts of Europe is the reverse of that which, according to the theory [of the older naturalists], ought to have happened. It is known that this

fish is now taken, even on some parts of our own coast, in every month of the year. It is probable that the Mackerel inhabits almost the whole of the European seas; and the law of Nature, which obliges them and many others to visit the shallower water of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which, not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man; who but for the action of this law, would be deprived of many of those species most valuable to him as food. For the Mackerel, dispersed over the immense surface of the deep, no effective fishery could be carried on; but, approaching the shore as they do, from all directions, and roving along the coast, collected in immense shoals, myriads are caught, which yet form but a very small portion compared with the millions that escape.

“It may be observed, farther, that, as there is scarcely a month throughout the year, in which the fishes of some one or more species are not brought within the reach of man, by the operation of the imperative law of Nature referred to, a constant succession of wholesome food is thus spread before him, which, in the first instance, costs him but little beyond the exercise of his ingenuity and labour to obtain.”*

It is said of the Char, a beautiful member of the Salmon family inhabiting our mountain lakes, and the fact is cited by the distinguished zoologist last mentioned, in confirmation of this hypothesis, that when it spawns, it is seen in the

* British Fishes, i. 138.

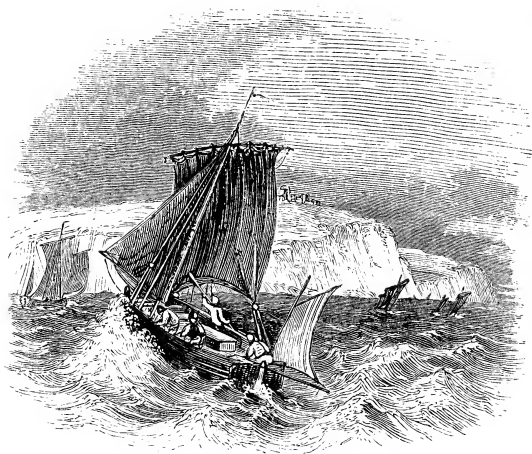
shallow parts of the rocky lakes (in which only it is found), and some of the streams that run into them: it is then taken in abundance; but so soon as the spawning is over, the fishes retire into the deepest parts of the lake, and are but rarely caught.*

The principal Mackerel fisheries are on the Devon and Cornwall coasts, the Norfolk and Suffolk coasts, and on those of Kent and Sussex. The London market is principally supplied from the latter. In the French fisheries a great number of the Mackerel taken are salted; and a few are so treated in Cornwall, and in the south and west of Ireland; but in this country, generally, this fish is consumed in a fresh state. It is, however, one of those species which are peculiarly liable to rapid decomposition, in which state it is said to be not only offensive, but scarcely less than poisonous. Hence it is highly expedient that it be transmitted to its final market with the least possible delay. The stringency of our laws against Sunday trading has been relaxed in favour of Mackerel, which, with milk, is the only article permitted to be publicly hawked through the streets of the metropolis on the Lord's day.

On such parts of the Kentish coast as are sufficiently near to the mouth of the Thames, the Mackerel fishing-boats are accompanied by fleet-sailing cutters, which collect the produce of the aggregated hauls as they are brought in, and run up with the wind and tide to Billingsgate, leaving the boats to pursue their fishing. From points farther to the westward, as Hastings and Brighton, it is found more convenient to send the pro-

* Mag. Nat. Hist. vii. 637.

duce to London by vans, which travel during the night. The carriages in which the fish are thus conveyed are exempted by law from the post-horse duty. We presume that the extension of railway commerce has materially affected the transmission of fish, as well as of other articles, whose value is impaired by delay. During favourable seasons one hundred thousand Mackerel are brought to Billingsgate every week. At Hastings, ten thousand eight hundred have been ob-



MACKEREL BOAT OFF HASTINGS.

tained in a single day by four boats ; and on the next day seven thousand by two boats. Sixteen boats brought into Lowestoffe a catch of Mackerel worth £5,252, the produce of one day's fishing, in 1821 ; and the fishery of that year on

the whole coast of Suffolk was estimated at £14,000. In 1823, the number of Mackerel taken at Yarmouth was computed at 1,420,000.

The capital employed in the Devon and Cornwall fishery was, some years ago, estimated at £200,000.

Two principal modes of net-fishing are employed for the capture of the Mackerel. The first is by *drift-nets*. A number of nets, twenty feet wide and twenty fathoms long, are attached by one side, in succession, to a stout rope, called the drift-rope, which is well corked. The boat being at the distance of some leagues from shore, throws overboard the end of the rope, to which is affixed a large buoy. She is then put before the wind, and as the rope runs out over the stern, the successive nets are carried overboard with it, and hang down perpendicularly like a long wall, to the depth of twenty feet from the floating rope. When all is run out, the rope is shifted from the stern to the bows, the sails are taken in, and the boat rides by the rope instead of her cable, which is thus kept taut, and in the line of the wind. The meshes of the nets are made sufficiently large to admit the head of the Mackerel, but no more; so that the fish, swimming against the long wall of nets, are caught by the gill-covers and prevented from advancing or retiring.

After remaining out, commonly, all night, the nets are hauled in by means of a capstan; each net is taken off in turn and its produce secured. A single haul has been known to yield fish of the value of nearly £70.

The second mode is by the *ground-seine*. "A coil of rope, about two hundred fathoms in length, with

the net fastened to one end, is tied, at the other, to a post or rock, on the shore. The boat is then rowed to the extremity of the rope, when a pole, fixed there, and leaded heavily at the bottom, is thrown overboard. The rowers from this place make as nearly as possible a semicircle, two men continually and regularly putting the net into the water. When they come to the other end of the net, where there is another leaded pole, they throw that overboard. Another coil of rope, similar to the first, is, by degrees, thrown into the water, as the boatmen make for the shore. The crew now land, and with the assistance of persons stationed there, haul in each end of the net till they come to the two poles. The boat is then again pushed off towards the centre of the net, in order to prevent the more vigorous fish from leaping over the corks. By these means three or four hundred fish are often caught at one haul.”*

Mr. Couch has described a variation in the use of this net, by which, in deep water, it is cast around a shoal of Mackerel, so as to inclose it, as if with a circular wall: then the bottom being drawn together, it forms a deep and wide bag, out of which the fishes are dipped into the boats. The former mode is, however, the less expensive of the two.

The boats employed in the drift-fishing are carefully built, combining security with speed in a degree, perhaps, not surpassed by those of any other of our fisheries. They are usually about thirty feet in the keel, with great depth of waist, and breadth of beam; built of oak or ash timber,

* Bingley's Animal Biography, iii. 261.

and copper-fastened. Great strength is requisite, especially in those employed on the Kentish coast, where the shore is rocky, and heavy shocks are continually sustained, as the boats take the beach.

“It is impossible to see the rich and varied shades of colour of the Mackerel in full perfection, except while it is actually in the water, or immediately after it has been taken. Nothing can be more exquisite than its formation, nothing better calculated to secure ease and rapidity of motion. No bulky mass to impede its natural activity, not an angle to present the slightest obstacle to its motion. Accordingly, the swiftness of the Mackerel is proverbial, outstripping the fastest sailing ship, and even seizing the bait while she is under her greatest way.”

A successful mode of capturing Mackerel is called “fishing with the fleet-line,” practised in a sailing-boat under a smart breeze. A strong thick line of twenty fathoms or more is provided, and coiled on a reel. In preparing for use, care is necessary to take out “the play,” or twist, to avoid tangling afterwards. This is effected by stretching it to its utmost length, and passing a rounded stick along it, one end being left free to untwist. In fishing, the boat must be kept in motion, more or less rapid. In order, therefore, to prevent the line from trailing along the surface, a plummet is attached to its extremity, through the neck of which is passed a piece of whalebone about eight inches long. The object of this is twofold; first, to prevent the whistling noise of the plummet, and secondly, to determine the direction of a finer line, called the *snood*,

to which the flies are attached. The weight of the plummet is a matter of some nicety, as on it depends the depth at which the hooks run; the greater the speed the heavier must be the lead, to insure the same depth; a pound and a half is the average weight.

The *snood* is about twelve feet in length, to carry the hooks clear of the plummet's wake. It is ordinarily formed of fine hemp, but sometimes of silk; a length of gut or weed, such as is employed in Salmon-fishing, may, with advantage, be interposed between the snood and the hook, but this is generally omitted. The bait must be conspicuous; almost anything showy or glittering, a piece of light blue leather, or a strip of scarlet cloth, is frequently successful; but the best is a slice taken from the side of a Mackerel, about two inches in length, and half an inch in breadth at the free end, tapering to the end which is affixed to the hook. A waving, vibratory motion is imparted to this bait, very much resembling that of a small fish.

Some practice is required in order to determine with precision when a fish is hooked. The weight of the lead, and the constant but unequal action of the water upon it, keep up a tremulous motion, that to the inexperienced hand feels very much like the jerking of a fish. Some skill, moreover, is needful in order to strike the fish, even if he have actually touched the bait. The Mackerel is said almost invariably to dart at the hook in a direction across its course. It is, therefore, needful to strike forward when a bite is felt, and after hauling in about a fathom of line to sway it, a moment, gently in the hand. The jerking

motion, as well as the increased weight, will tell if a fish be hooked.

The author of "Wild Sports of the West" has graphically depicted his own participation in such a fishing, on the wild and tempest-beaten coast of Connaught. "It was evident that the Bay was full of Mackerel. In every direction, and as far as the eye could range, gulls and puffins were collected; and, to judge by their activity and clamour, there appeared ample employment for them among the fry beneath. We immediately bore away for the place where these birds were most numerous congregated; and the lines were scarcely overboard when we found ourselves in the centre of a shoal of Mackerel.

"The hooker [or boat] however, had too much way; we lowered the foresail, double-reefed the mainsail, and then went steadily to work. Directed by the movements of the birds, we followed the Mackerel, tacking or wearing the boat occasionally, when we found that we had overrun the shoal. For two hours we killed those beautiful fish, as fast as the baits could be renewed and the lines hauled in; and when we left off fishing, actually wearied with sport, we found that we had taken above five hundred, including a number of the coarser species, known on this coast by the name of Horse Mackerel.*

"There is not on sea or river, always except angling for Salmon, any sport comparable to this delightful amusement; full of life and bustle, everything about it is animated and exhilarating; a brisk breeze, a fair sky, the boat in quick and constant motion, all is calculated to interest and

* *Caranx trachurus*, LACEP.

excite. He who has experienced the glorious sensations of sailing on the Western Ocean, a bright autumnal sky above, a deep green lucid swell around, a steady breeze, and as much of it as the hooker can stand up to, will estimate the exquisite enjoyment our morning's Mackerel-fishing afforded."

The fishes of this fine Family are predatory and voracious, devouring great numbers of fishes smaller than themselves, which their muscularity and high powers of swimming enable them to overtake and subdue with facility. The Mackerel offers no exception to this character of the Family; it pursues with eagerness the fry of other fishes, and in particular the young of a small species of *Clupea*, which Mr. Yarrell supposes to be the Sprat.

On our southern coast the Mackerel deposits its spawn in June, which is hatched by the end of the month. The young fry increase rapidly in size, so that by the end of August they are found from four to six inches in length, and by November have attained half their adult growth. About this time they retire into deep-water, and appear no more as fry.

FAMILY X. CEPOLADÆ.

(*Ribbon-fishes.*)

The greatly compressed form of the Coryphenes, in which the vertical diameter so greatly exceeds the transverse, and the elongation of some among these, prepare the student for the contemplation of the present Family, in which

these two characters, thinness and length, are found in so extraordinary a degree, as to suggest the idea of a piece of tape, or ribbon; each of which fabrics has given a name to its members. So gradual indeed, is the transition from the *Scombridæ* to the *Cepoladæ*, that certain of the connecting forms have been placed by some naturalists in the one, and by others in the other. Thus *Pteraclis*, that singular American fish before referred to (see the engraving on page 55), has the compressed silver-plated body of the Ribbon-fishes, with the fins (in excess) of the Coryphenes; and is, by Cuvier, assigned to the latter; by Swainson to the former; while of the Silvery Hair-tails (*Trichiurus*), and the Scabbard-fishes (*Lepidopus*) the reverse is true; the French zoologist marshalling them in the ranks of the Ribbon-fishes, the English giving them companionship with the Coryphenes.

The technical characters, as indicated by Cuvier, which belong to this Family, are somewhat vague; being simply the following: "these fishes are long, flattened sidewise, and have very minute scales." Each of these characters, however, we have seen to belong to some of the *Scombridæ*, only in a rather less extreme degree. Thirty-four species are at present included in the Family; the majority of which have been made known at a comparatively recent period. They are for the most part pelagic in their habits; that is, they rove in the open sea, far from the land. The warmer parts of all the oceans produce them, and not a few are natives of the Mediterranean. Some extend their range into the colder seas of the north, and two or three species are occa-

sionally presented to the notice of British naturalists, being found washed up by the violence of the waves on the rocks or beach. Though so limited in number, the fishes of this Family constitute three Sub-families, distinguished principally by the form of the head and mouth.

1. *Cepolina*. In these the muzzle is short, and the mouth cleft obliquely, so as to open upwards; the body is deepest at the head, and diminishes gradually to the tail, which is furnished with a distinct caudal, though united to the dorsal, as also to the anal, where this last is present. Most of the species are natives of the Mediterranean.

2. *Gymnetrina*. Here the mouth is small and little cleft; the body is excessively long and thin; the dorsal extends the whole length; the anal is wanting; the pectorals are minute, but the ventrals remarkably developed.

3. *Trichiurina*. In this group the muzzle is lengthened, the mouth deeply cleft, and armed with strong trenchant teeth, the lower jaw projecting beyond the upper, with a pointed chin. The dorsal is long, but not united with the caudal: the ventrals are wanting, as are, in one genus, the anal, and the caudal also.

“The Ribbon-fishes,” remarks Mr. Swainson, who seems to have been personally familiar with not a few species, “although vastly inferior, in point of number, to either of the more typical divisions, is yet one of the greatest interest, since it contains the most singular and extraordinary fishes in creation. . . . The form of the body, when compared to fishes better known, is more like that of the Eel, the length

being in the same proportion to the breadth; but then it is generally so much compressed, that these creatures have acquired the popular names of Riband-fish, Lath- or Deal-fish, &c. The body, indeed, is often not thicker, except in its middle, than that of a sword; and, being covered with the richest silver, and of great length, the undulating motion of these fishes in the sea, must be resplendent and beautiful beyond measure. But these, and all the wonders of the mighty deep, are almost hidden from the eye of man. These meteoric fishes appear to live in the greatest depths; and it is only at long intervals, or after a succession of tempests, that a solitary individual is cast upon the shore, with its delicate body torn and mutilated by the element, or by the rocks. Such may be truly said of nearly all the genera contained in the tribe, the only exception being those of *Cepola* and *Ophidium*,* which have a more compact and robust organization, and habitually frequent the same moderate depths as the generality of edible fish."

GENUS *CEPOLA*. (LINN.)

The Band-fishes proper are distinguished by having the body moderately lengthened, compressed, very gradually diminishing in height from the head to the tail; the head short, rounded, the mouth opening obliquely upwards; the dorsal and anal fins very long, united to the caudal; all the spines of the dorsal flexible; pecto-

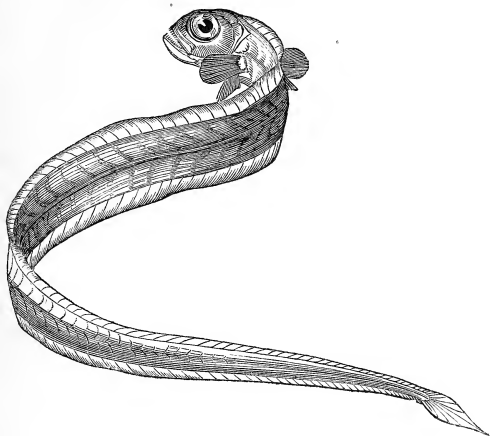
* This genus, however, is by Cuvier arranged in the Order of Soft-finned Fishes, among the Eels: by Prince Bonaparte, among the Cods.

rals small, rounded ; ventrals small, pointed, situated immediately beneath, or rather before the pectorals, composed of stiff rays, attached by a membrane at their base ; teeth prominent, curved, and sharp ; stomach and intestines very short, terminating a little way behind the head ; air-bladder very long, reaching to the tail.

About nine species of this genus have been described, perhaps, however, not sufficiently distinct from each other, most of which inhabit the Mediterranean. One or two are occasionally seen on the Atlantic shores of Europe, and one species inhabits the Chinese seas. They differ very little in form ; the shape of the caudal fin, the number of its component rays, and the position of the pectorals and ventrals with respect to each other,—constituting the distinctions which have been relied on as specific. In colour their resemblance is equally exact ; a delicate tint of pink, in some specimens, even of the same species, deepening to a light vermilion, in others fading to a carnation or flesh-colour, is the universal hue, adorned in life with pearly, or silvery, or metallic reflections ; the fins are party-coloured in bands.

The Eleven-rayed Band-fish (*Cepola rubescens*, LINN.) has been found on the shores of this country ; numerous specimens having occurred of late years (if indeed all of them were of this species) principally on the coasts of Devonshire and Cornwall. Some of these attained the length of twenty inches ; all were of the tender hue of pale red, varying in intensity, described above, and some displayed the brilliant colours of the long fins, which Mr. Swainson informs us, from

his personal observation, in the Mediterranean, adorn these fishes in their living state,—viz., the margin of the fin purple or dark red, the basal



BAND-FISH.

part pink, and the intermediate portion orange or yellow, a combination of tints very ornamental. The caudal has eleven rays, of which the middle one is the longest; its shape is that of a spear-head.

The Band-fish is sometimes taken with the hook, but such a circumstance is rare; and naturalists are in general indebted for their acquaintance with it to the violence of storms. Noticing this fact, Mr. Yarrell makes the following suggestions. “Does their elongated form prevent their swimming with ease in mid-water, and,

inducing a habit of keeping near the ground, or occasionally seeking cavities among rocks for shelter, thus render them liable to be left dry by the retiring tide, or destroyed by the force of waves dashing them against such opposing substances? The combination of great length with extreme tenuity of body, by diminishing the quantity of muscle, and at the same time preventing its being brought into concentrated action upon a single centre of motion, must necessarily leave them at all times much at the mercy of the currents, amid which they may wriggle or float, but against which they are evidently incapable of swimming with any vigorous effort; by their struggles in the ocean, they cannot fail to be speedily exhausted, and they are rejected by the waves like inanimate matter, upon any coast towards which the winds may have driven them. All observers agree that the *tænioid* [or ribbon-like] fishes are decidedly pelagic.”*

According to Mr. Swainson, one species at least of the genus is quite commonly met with on the coasts of Sicily, and is habitually exposed for sale in the fish-shambles of that island. From other sources, however, we learn that the flavour of its flesh is not held in much esteem. M. Risso asserts that on the Mediterranean coasts of France, the Band-fish lives principally among sea-weeds in the vicinity of the shore, feeding on *crustaceous* and *molluscous* animals. The statements of these naturalists, therefore, do not seem to confirm the general opinion of the oceanic habits of this Family; or at least imply a less

* British Fishes, i. 227.

exclusive applicability of it to this particular genus. According to the last named authority, the common species has obtained at Nice, the names of Fire-flame and Red-ribbon; the former of which appellations it owes to its glittering appearance, as it shoots, meteor-like, through the water.

The appropriateness of the term Ribbon-fish to this species, is well-shown by an incident recorded in the Magazine of Natural History for 1838. A specimen, which had been obtained on the Irish coast, was sent to Mr. W. Thompson of Belfast, through the post-office. The penny stamp was not at that time introduced, but the fish, though nineteen and a-half inches in length, having been carefully *folded up like a ribbon*, passed in a franked letter of the ordinary size, and legal weight, viz., less than an ounce.

FAMILY XI. TEUTHIDIDÆ.

(*Spine-tails.*)

This is a compact and very natural Family, containing a great number of species, many of which are remarkable for the beauty of their forms, and for the brilliancy of their colours. About eighty species are enumerated, excluding the extensive genus *Siganus*, placed here by Cuvier, but which seems rather to belong to the Mackerel alliance. They are exclusively natives of the warmer parts of the globe; the tropical seas of both hemispheres, especially those of the East and West Indies, being the chief homes of the Family.

In form and general appearance the Spine-tails resemble the Chætodons, with which Linnæus associated them. They are marked by the body being short, and greatly compressed; it has been stated, that "the depth of the body, measured from the dorsal to the pectoral fins, is always equal to, and often exceeds, its length from head to tail;" but this is certainly not the case with the most typical forms. There are teeth only in the jaws; these are trenchant and denticulated, like the teeth of a very fine comb: the mouth is small, advanced, but not projectile. The fins are much developed; they are supported by numerous slender rays, and are destitute of scales; the dorsal and anal are long; and the caudal is forked, the points frequently being produced into filaments. But the most remarkable character of these fishes is the presence of moveable spines set on each side of the fleshy part of the tail, the points and edges of which are as sharp as those of lancets. With these weapons they inflict dangerous wounds on the hands of such as handle them incautiously. These lancets have procured for them the familiar name of "Doctors," by which they are generally known to sailors and colonists.

GENUS *ACANTHURUS*, (LACEP.)

The sides of the tail in this genus are armed each with a single lancet only; the body is oval, covered with minute scales; the mouth very small and projecting; the dorsal is long and undivided, supported, as is also the anal, by numerous rays, of great slenderness, set very

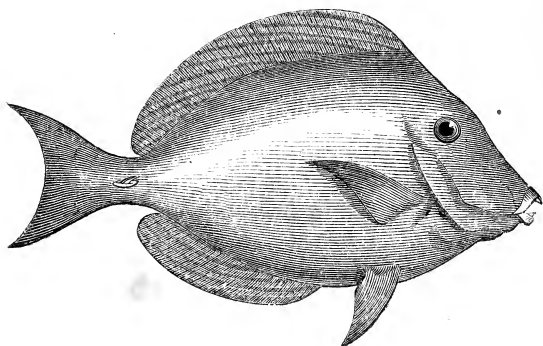
close together; the caudal is large, forked, or crescent-shaped; the upper division sometimes more developed than the lower; the head is obtuse and high, the profile approaching to vertical.

The fishes of this genus are reckoned among that small number of the Class which feed entirely on vegetable substances: sea-weeds, and such like marine vegetation, that may generally be found fringing the submerged rocks in the tropical seas, afford them an always abundant repast. One result of this diet is, that the flesh, though commonly eaten, has a peculiar flavour, disagreeable to many persons. The intestinal canal, as usual in herbivorous animals, is long and complicated.

We must consider the caudal lancets of these fishes as defensive, rather than offensive, weapons, analogous to the horns of the ruminant Mammalia. They are highly curious; each consists of a curved, flattened spine, lodged in a membranous sheath in the side of the tail, and ordinarily concealed; but capable of being partially elevated, as on a hinge, at the will of the animal, when its acute point and keen edge are found to point backward. They are exceedingly firm in texture, of a hard crystalline substance; and being violently jerked from side to side, by the action of the powerful lateral muscles, they doubtless constitute formidable weapons, and enable the browsing fish effectively to repel any carnivorous foe that may be inclined to attack him in the rear.

We shall illustrate the genus by a species which the inhabitants of Jamaica distinguish as the White Doctor-fish (*Acanthurus cæruleus*,

Cuv.); which we here figure and describe from our own observations on specimens newly caught. It attains a total length of about six inches: the body is of a purple hue more or less brilliant; the dorsal, anal, and ventrals are of a rich azure



DOCTOR-FISH.

blue, the two former marked with longitudinal lines of dark brown. The caudal lancets are short, hard, and glassy; and are enclosed in a yellow membranous sheath. This species is common on the coasts of Jamaica and the other Antilles, where it is eaten, but is not much esteemed.

FAMILY XII. OPHIOCEPHALIDÆ.

(Cell-throats.)

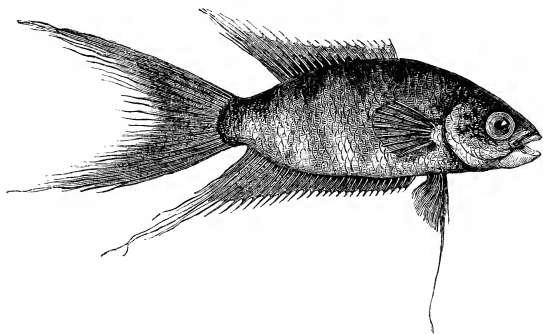
These are fresh-water fishes, all inhabiting with one exception (an African species) the rivers of India. They are chiefly interesting because they possess certain peculiarities of internal structure, which distinguish them from all other fishes, and which are connected with habits and powers no less anomalous. The bones of the throat (or *pharynx*) are divided into small thin plates more or less numerous; and these form, by their frill-like undulations and contortions, intercepting cells, in which water can be retained, and whence it can flow forth upon the gills and keep them moist for a long time, when the fish is on the dry land. By this structure the members of the Family are enabled to crawl from the rivers and ponds which they usually inhabit, and migrate to others at a distance; or, as some suppose, hide themselves in holes in the muddy banks, during the season of drought, waiting for the return of the periodical rains to restore them to activity. It is affirmed by persons of veracity who have lived long in India, that in ponds which perfectly dry up, the bottom being hard and cracked, fishes are found a few days after the commencement of the rainy season, though no rivers or brooks flow into them. The size of the newly found fishes will scarcely admit the explanation which has been suggested of this phenomenon, viz., that they are just hatched from ova which had been deposited in the mud

in the previous season; though it is difficult to imagine that perfect fishes can sustain life for several weeks or months without water. The common Hindoos stoutly maintain that they are precipitated from the clouds with the falling rains.

These fishes have, in general, the abdominal cavity very short, the tail commencing near the head, and being much lengthened; the fins are sometimes singularly developed. The genus *Ophiocephalus* has the body cylindrical and lengthened, with a head much like that of a snake.

GENUS *MACROPODUS*, (LACEP.)

We find in this small genus an extraordinary development of the fins; the caudal is excessively



ELEGANT LONG-FIN.

large, deeply lunate or forked, larger in fact than in any other known fish. The dorsal and anal have the final soft rays gradually lengthened and terminating in filaments; the ventrals have

the second ray produced into a long filament, while the others are of the usual size: the anal is longer than the dorsal.

We illustrate the genus by the Elegant Long-fin (*Macropodus venustus*, Cuv.), a native of the great rivers of India.

FAMILY XIII. MUGILIDÆ.

(*Mullets.*)

The well-known fishes of this Family are often spoken of as *Grey* Mullets, to distinguish them from the *Mullidæ*, which are frequently mentioned as *Red* Mullets; though it is perhaps better, as less likely to create confusion of ideas, to use the term *Mullets* for the one and that of *Sur-mullets* for the other. The true *Mullets* then are distinguished by the following characters. The body is oblong, somewhat narrow, more or less cylindrical, clothed with large scales. The head is somewhat depressed, covered with large angular scaly plates; the muzzle is short and obtuse, slightly projecting over the mouth, which is small, transversely cleft, and forming, when closed, an angle, the lower jaw having an eminence in the middle corresponding to a hollow in the upper: the eyes are large and placed near the muzzle. The teeth are very minute, and in some almost imperceptible; there are six gill-rays; the bones of the pharynx are so much developed as to give an angular form to the gullet. There are two dorsals, remote from each other, the first consisting of four strong spinous rays; the ventrals are a little behind the pectorals; the caudal is forked

or lunate. The stomach terminates in a fleshy gizzard, resembling that of a bird.

The Mulletts, according to the Prince of Canino's recent conspectus, amount to eighty known species; but if we include the Atherines, or Sand-Smelts, which Cuvier and Yarrell unite with this group, but of which the Roman zoologist constitutes a separate Family,—we shall have fifty more species. They are widely scattered over the globe, inhabiting both fresh and salt waters. The European species are gregarious, haunting the coasts in large shoals, entering the mouths of rivers at certain seasons, and periodically returning to the sea. Experiments, however, have proved that they will not only live but thrive, when confined to fresh water. Mr. Arnold of Guernsey, having a lake of fresh-water about three acres in extent, put into it marine fishes of various species for trial, among which was the Grey Mullet. Selecting a number of the fry, of about a finger's length, he transferred them to the pond, and found, after a few years, that the Mullet were the most improved of all the sea-fishes that he had introduced. Specimens of these, weighing four pounds, were taken from the pond, and proved fatter, deeper, and heavier, than others of similar length which were taken in the sea.

The Mountain Mullet (*Mugil monticola*) of Jamaica, and another species that inhabits the fresh-water streams of that island, are found in situations which almost preclude the supposition of their ever visiting the sea.

It is commonly believed that the Mullet is not a carnivorous fish, but that it confines itself to

oily substances floating on the sea, or to the softer parts of aquatic vegetation. The ancients considered it as the most innocent of fishes, and this opinion has been confirmed by that of one of our best ichthyologists, Mr. Couch. Yet the observations of other naturalists reveal a very different truth. Mr. W. Thompson, the able historian of Irish zoology, has remarked, after an examination of many individuals of the species common in Belfast Bay (apparently *Mugil chelo*), that they presented many hundred-fold greater destruction of animal life than he had ever witnessed on a similar inspection of the food of any bird or fish. From the stomach of a single individual he took as many univalve and bivalve *mollusca* as would fill a large sized breakfast cup; so that one of these stomachs might justly be regarded as quite a store-house to a conchologist.*

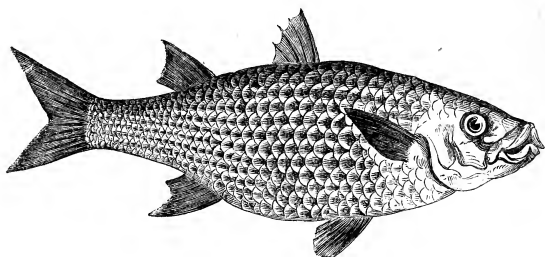
GENUS *MUGIL*. (LINN.)

The characters already enumerated as distinguishing the Family may be considered as those of this genus: the head is covered on the top with hard bony plates, on the sides with compact scales, which conceal the divisions of the gill-covers: the pectorals are pointed; the sides of the tail are not armed with projecting ridges.

Two species are common on the coasts of these islands, the Common Grey Mullet (*Mugil capito*, Cuv.) and the Thick-lipped Mullet (*M. chelo*, Cuv.) They very closely resemble each other, but are distinguished by small anatomical pecu-

* Ann. and Mag. of Nat. Hist. July, 1838.

liarities in the development of the bones of the head and face. The former is the most familiar species on the south and east coasts of England, the latter on the shores of Scotland and the north



GREY MULLET.

of Ireland. At certain seasons, however, as in the months of September and October, Dr. Parnell has observed *M. chelo* in great abundance on the Devonshire coast. Both are common in the Baltic and Mediterranean Seas.

The Common English Mullet attains a length of eighteen or twenty inches, of which the head is nearly one fourth. The colour of the body is bluish-grey on the upper part, silvery white on the sides, marked with longitudinal dusky lines; pure white on the belly; the membranes of the fins are pellucid-white. The caudal fin is both long and wide.

The habits of this interesting fish have been minutely described by Mr. Couch, and we shall take the liberty of quoting them at length from Mr. Yarrell's excellent "History of British Fishes."

“ This fish never goes to a great distance from land, but delights in shallow water, when the weather is warm and fine ; at which time it is seen prowling near the margin in search of food, and imprinting a dimple on the placid surface as it snatches beneath any oily substance that may chance to be swimming. It ventures to some distance up rivers, but always returns with the tide. Carew, the Cornish historian, had a pond of salt-water, in which these fish were kept ; and he says that, having been accustomed to feed them at a certain place every evening, they became so tame, that a knocking like that of chopping would certainly cause them to assemble. The intelligence this argues may also be inferred from the skill and vigilance this fish displays in avoiding danger, more especially in effecting its escape in circumstances of great peril. When enclosed within a ground-seine, or sweep-net, as soon as the danger is seen, and before the limits of its range are straitened, and when even the end of the net might be passed, it is its common habit to prefer the shorter course, and throw itself over the headline, and so escape ; and when one of the company passes, all immediately follow.

“ This disposition is so innate in the Grey Mullet, that young ones of minute size may be seen tumbling themselves head over tail in their active exertions to pass the head-line. I have even known a Mullet less than an inch in length, to throw itself repeatedly over the side of a cup in which the water was an inch below the brim.

“ Mulletts frequently enter by the flood-gates into

a salt water mill-pool at Looe, which contains about twenty acres ; and the larger ones, having looked about for a turn or two, often return by the way they had come. When, however, the return of the tide has closed the gates, and prevented this, though the space within is sufficiently large for pleasure and safety, the idea of constraint and danger sets them on effecting their deliverance. The wall is examined in every part ; and when the water is near the summit, efforts are made to throw themselves over, by which they are not uncommonly left on the bank, to their own destruction.

“ When, after being surrounded by a net, two or three have made their escape, and the margin of the net has been secured, and elevated above the surface, to render certain the capture of the only remaining one, I have seen the anxious prisoner pass from end to end, examine every mesh, and all the folds that lay on the ground ; and at last, concluding that to pass through a mesh, or rend it, afforded the only, though desperate, chance of escape, it has retired to the greatest possible distance, which had not been done before, and rushed at once to that part which was most tightly stretched. It was held, however, by the middle ; and conscious that all further effort must be unavailing, it yielded without a further struggle to its fate.

“ The Grey Mullet selects food that is soft and fat, or such as has begun to suffer decomposition ; in search of which it is often seen thrusting its mouth into the soft mud ; and, for selecting it, the lips appear to be furnished with exquisite sensibility of taste. It is, indeed, the only fish

of which I am able to express my belief that it usually selects for food nothing that has life; although it sometimes swallows the common sandworm. Its good success in escaping the hook commonly proceeds from its care not to swallow a particle of any large or hard substance, to avoid which it repeatedly receives the bait into its mouth, and rejects it; so that when hooked it is in the lips, from which the weight and struggles of the fish often deliver it. It is most readily taken with bait formed of the fat entrails of a fish, or cabbage boiled in broth.

“The Grey Mulletts shed their spawn about Midsummer; and in August the young, then an inch long, are seen entering the fresh-water, keeping at some distance above the tide, but retiring as it recedes. The change and rechange from salt water to fresh seems necessary to their health, as I judge from having kept them in glass vessels.”*

The agility displayed by this fish in escaping from danger, and the sagacity which impels it to put its powers into requisition, were known to the ancients as well as to modern fishermen. The continental fishers often lose a whole shoal in the manner described by Mr. Couch, a single one leaping the net-line, and all the rest following like sheep at a fence-gap. To obviate such a disappointment they use in some parts of the Mediterranean a sort of double net, so formed that the exterior net shall receive those fishes that overleap the interior. Oppian long ago thus celebrated the prowess of this fish:—

* Yarrell's British Fishes, i. 236.

“ The Mullet, when encircling seines enclose;
The fatal threads and treach’rous bosom knows :
Instant he rallies all his vigorous powers,
And faithful aid of every nerve implores ;
O’er battlements of cork up-darted flies;
And finds from air th’escape that sea denies.”

The opinion expressed of the harmless appetite of the Grey Mullet we have already seen reason to qualify ; the fact of its being often the prey of the fly-fisher seems also inimical to such a conclusion. It is said to rise freely at the flies used for Trout, and even at the larger and more gaudy flies used for Salmon. Now though these showy temptations from the angler’s cabinet are but combinations of hair, feathers, and the like, yet they profess to be imitations of living flies, and the eagerness with which the fish leaps up at the skilful mimicry, sufficiently proves how he would act if the filmy-winged insect itself were dancing on the smooth surface of the stream.

The excellence of the flesh of these fishes is generally acknowledged, and they are in considerable request for the table ; they are in the best condition about the end of August. In the south of Europe a kind of *caviare* is made from the roe of the Grey Mullet. It is prepared in the following mannér : the fish is opened, the roes taken out, washed, and salted. After having lain in salt for a few hours, they are subjected to pressure between boards, that the water may be expressed. They are then washed in weak brine, and exposed to the rays of the sun. As the operation takes place in summer, when the roe is just ready for deposition, the heat of the weather is sufficient to dry the *caviare* fit for the market in ten or fifteen days.

Mullet swim in large shoals, roving from place to place, near the surface of the sea. When the fishermen perceive an unusual rippling of the water, they recognise in it a shoal of fishes; and if it have a peculiar blue appearance, they know the shoal to be Mullet. They are chiefly caught with the seine. Large quantities are sometimes taken. Mr. Thompson states that on the 1st of May 1838, seven hundred weight of these fishes were caught at a single draught, and on the same night, nine hundred-weight were secured by the crew of another boat. Mr. Couch has heard of two tons' weight being taken at one time. All of these statements refer to the Thick-lipped Mullet. A Mullet is considered large if it weigh five or six pounds; but ten or twelve pounds are sometimes attained, and one is mentioned by Mr. Thompson, which weighed fourteen pounds and three-quarters.

FAMILY XIV. GOBIADÆ.

(Gobies and Blennies.)

This is a vast assemblage of small and unimportant fishes, scarcely any of which are of the least value to man, and of which the great majority possess little beauty to recommend them to notice. Some of them, however, are distinguished by peculiarities of instinct and of habit, of very high interest to the philosophical student of nature. The Prince of Canino, in his last conspectus, elevates this group into the rank of an Order, including in it the Frog-fishes, which we shall consider next after the present, as well

as the Suckers and Remoras, which Cuvier places among his MALACOPTERYGII. The number of species contained in the group, if we exclude these three Families, are given by the Italian zoologist as four hundred and eight, a vast increase upon the number recognised in 1831, when, according to the same authority, the Family contained one hundred and seventy three species.

The bodies of these fishes are generally soft to the touch, and invested with a mucous slime; hence the name applied to one of the great subdivisions, the term Blenny being derived from the Greek *Βλεννα*, signifying *mucus*; and the provincial appellations of some of the species, as Butter-fishes, &c., allude to the same peculiarity.

The *Gobiadæ* have either one lengthened dorsal or two: the rays which are spinous are so in a less degree than in any other tribe of this Order, being remarkable for slenderness and flexibility. Few, if any, of this species have robust rigid rays in any of the fins. The ventrals manifest peculiarities of structure: they either consist of two or three small rays, or are enveloped in a thick skin, or are so united as to make a funnel-shaped cup, or are totally wanting. In general these fins are situated in front of the line of the pectorals. All the species have a long uniform, intestinal canal, destitute of cæca; the air-bladder is generally wanting.

The genera are widely scattered; they are found in all the seas of both hemispheres, from the polar oceans to the equator; one genus is confined to the Indian coast, another to the Molucca Isles, and another to the Sea of Kamschatka:

others inhabit rivers, some are found only in the fresh-water marshes of tropical countries, and one genus is peculiar to the lake of Baikal, that great Alpine sea of fresh water that lies embosomed among the mountains in the very heart of Asia.

There are three well-marked sub-families of the *Gobiadæ*, which are thus discriminated.

1. *Blennina*. The ventrals in this group are very small and thick, consisting of not more than two or three cylindrical rays each, enveloped in the common skin: the head is thick, fat, and obtuse; the lips are thick and fleshy. The body is compressed and lengthened, clothed with minute scales, and enveloped in an unctuous slime. There is one long dorsal, composed almost entirely of unjointed, but flexible rays. About one hundred and seventy species are contained in this sub-family, of which eight are natives of our own seas: the rest are spread over the fresh and salt waters of the countries that border the Atlantic, almost exclusively. Mr. Swainson indeed says, "it appears that this Family is distributed over every part of the world but Asia; or at least it is a singular fact, that in the two best works we yet possess upon the fishes of India, not one species has been recorded."* But he has overlooked *Salarias*, *Cirrhibarba*, and *Opistognathus*, which are all Indian genera. The Blennies are almost all fishes of very small size and insignificant appearance, rarely exceeding a few inches in length. To this statement, however, there is one exception, the Wolf-fish, or Sea-cat (*Anarrhichas lupus*, LINN.), of the northern seas, which is of no infrequent occurrence on the Scottish coasts. This

* Monocardians, ii. 72.

is a truly formidable creature, attaining the length of seven feet, and its hideous, broad, cat-like face, and its wide grinning mouth, bristling with stout sharp teeth, give it a most revolting aspect, while it is endowed with a strength and a ferocity conformable to its appearance. "It is remarkably strong, very active, and equally ready to defend itself or attack an enemy. It often enters the fishermen's nets for the purpose of plundering them of the entangled fish; and when the fishermen attack it, and it cannot dart through the net, it fights like a lion. They maul it with hand-spikes, spars, and such heavy timber as they may have in the boats; but even when it is landed, and apparently dead, they are not quite safe from its bite." Its teeth resemble the canines and molars of quadrupeds, and their strength is so great as to break down and crush the hardest shells, and even stones. The flesh is excellent, yet such is the prejudice with which its ferocious face and long slimy body are viewed, that the common people turn from it with disgust.

2. *Gobiana*. These are remarkable for having the ventral fins fully developed, and united, either for their whole length, or at their bases, into a single hollow disk, shaped more or less like a funnel, analogous to that of the soft-finned *Cyclopteridæ*, formed in the same manner, and applicable to the same use, that of a sucker, whereby they affix themselves to rocks and other substances. The rays of the dorsal (of which there is either one or two) are flexible. The gill-aperture is small, and these fishes can in consequence live a long time out of the water. Some of these

are viviparous, as we shall presently see of the Blennies.

3. *Callionymina*. Here the ventrals are separate, larger than the pectorals, and placed far forward under the throat. There are two dorsals, sometimes much elevated. The head is oblong, flattened, with the eyes looking upwards, and with a very small hole on each side of the nape, for the gill-opening. They much resemble the Gurnards in shape and aspect; they are small fishes with a smooth skin, covered with slime, but often adorned with brilliant colours. The mouth is small and very protractile, and the jaws are studded with small, thickly-set teeth.

Two species of this group are found on the British shores, called Dragonets. One of these, the Gemmeous Dragonet, (*Callionymus lyra*, LINN.), is a little fish of unusual brilliancy. The body is yellow of various tints, with the head and sides marked with spots, dashes, and lines of sapphire-blue: the dorsal-fins are pale brown, crossed by several bands of black. All the fins are very large, but the two dorsals in particular are elevated in the form of high sails, and the first is tall, slender, and curved like a crescent.

To this group is assigned that singular fish, which has been already alluded to as inhabiting Lake Baikal, (*Comephorus Baicalensis*, PALL.)* While agreeing, in many points with the other species, there are some important ones in which it differs, particularly in the total absence of ventral fins. Pallas's account represents it as varying from four to six inches in length, with a broad depressed head, and a soft unctuous body.

* Nov. Act i. 9.

Indeed, except the head, a very thin back-bone, the skin, and the fins, the whole fish seems to be composed of solid fat, which melts over the fire into very fine train-oil, which may be used nearly like olive-oil. What renders this fish most remarkable is the circumstance that it had become known to the fishermen of Lake Baikal for the first time, only five years before the visit of Pallas, and that, in 1770 and 1771, it made its appearance in such immense numbers, that the dead fishes in some places, and particularly near the mouth of the Bargusin, covered the shores to the depth of several feet. In 1772 it had again become so rare that Pallas and Georgi had some difficulty in procuring a few specimens. Pallas expresses his opinion that this fish generally lives near the bottom of the lake, in the greatest depths, and that it was carried to the surface, in the above-named years, by some draughts of gas or air; but, being here out of its element, languished and died; for the fishes were invariably taken out either actually dead, or in a very languid state. The oil is sometimes obtained from the flesh of these fishes by subjecting them to pressure instead of heat; it is of considerable value, and, on being sent to the markets of China, finds a ready sale.

GENUS *BLENNIUS*. (LINN.)

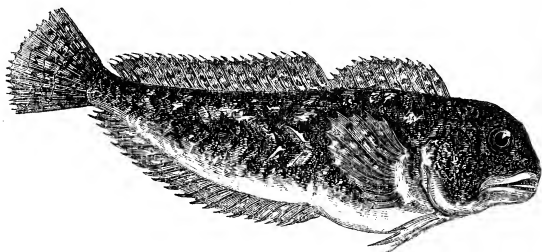
In this numerous genus the mouth is small, with teeth long, slender, conical, equal, and closely-set, arranged in a single row, generally with a canine on each side: the head is thick and obtuse, the muzzle short, the profile nearly vertical.

The dorsal is generally emarginate, or interrupted in its outline near the middle. Most of the species are furnished with a fringed appendage over each eye, and some have another on each temple. The intestines are wide and short.

These little fishes live in small troops, in the shallow pools and channels among the rocks of the coast, swimming and leaping to and fro with much agility. Their smooth lubricated skin, and general softness of flesh have been already adverted to. They are abundant enough, but their minute size renders them unworthy of attention, and in this country, we believe, they are never cooked; in Italy, however, they are fried in numbers, like sprats in England, and eaten by the poorer classes. They are said to feed on small crustacea and other animals, which they obtain from among the weeds in which they hide. Mr. Couch found in the stomach of one various bivalve shells, parts of a star-fish, the common jointed coralline, and brown seaweed.

Cuvier states that many of the Blennies are viviparous, and though we are not aware that this is the case with any of the British species of the restricted genus before us, we have one of a genus closely allied, which bears the title of Viviparous Blenny (*Zoarces viviparus*, Cuv.) from this remarkable habit. It is not uncommon on the rocky shores of Scotland, and is occasionally brought, though by no means of inviting appearance, to the Edinburgh market. The female produces her young alive and fully formed, but varying in size, as it appears, (though this circumstance is certainly strange,) according to

her own dimensions. Mr. Yarrell obtained a specimen *seven* inches long, full of young ready for birth, which were *one inch and a half* long. Mr. Neill, on the other hand, observed in the market at Edinburgh, a female *fifteen* inches in length, from which several dozens of living young escaped; and these were from *four to five* inches long. Mr. Low, in his Fauna of the Orkney Islands, observes, that when the fact of the viviparous habit of this fish first fell under his notice, he put a number of the small fry into a tumbler of sea-water, in which he kept them alive for many days, changing the water at every tide. They grew considerably larger, and continued very lively, until one hot day, when, unfortunately forgetting to provide them with a fresh supply of water, they died to the very last fish.



SMOOTH BLENNY.

The most common of our Blennies is the Shanny (*Blennius pholis*, LINN.), sometimes called the Smooth Shan, an epithet probably alluding to the absence of those fringed appendages to the head with which all our other true Blennies are furnished. Its form will be perceived from

the above engraving: in colour it is very variable; generally some shade of brown prevails, from plain drab, or dull wood-brown, to reddish-brown, usually darker above than below, and frequently mottled on the sides.

The habits of this fish, as far as recorded, seem generally those common to the genus. Its want of an air-bladder compels it to live for the most part at the bottom, usually selecting some piece of rock as its home, about which it plays, and under which it hides when danger approaches. At the recess of the tide, according to Mr. Couch's observations, the larger individuals, that cannot find concealment in pools or beneath the stones, quit the water, and by means of their pectorals creep into holes, rarely more than one in each, where, lying with the head pointing outward, they patiently wait the return of the tide to set them at liberty. Should they be alarmed when thus watching, they retreat backward to the bottom of their caverns. The observant zoologist, who records these facts, infers from them that the Shanny is retentive of life, in further proof of which he mentions that he has known it to continue lively after a confinement of thirty hours in a dry box; though immersion in fresh water would be presently fatal to it.

Colonel Montagu has also remarked on the Shanny's tenacity of life; stating that it will live out of water for many days in a damp place, especially if put into fresh grass or moss moistened with sea-water, and presuming that with a little attention it might be kept alive in this way for several weeks.

In our account of the habits of the *Trigladæ*,

we were led to speak of the nest-making instinct of a species of Stickleback, and extracted some particulars from a communication of great interest made to the Royal Institution of Cornwall. In the same paper the author gave an account of two other fish-nests, one of which was found to belong to the present species. "It may perhaps be doubted whether the term *nest* is strictly applicable to this, as the fish merely makes use of a natural cavity in the rock, in which the ova are deposited, and remain adherent; but as it shows a deviation from what has been considered as the usual mode of spawning in fish, it may be briefly noticed. The cavities selected are almost always nearer the low than high water-mark; they have generally rather narrow openings, and the roofs are smooth, or are at least not much broken by fissures. On the roofs and sides of such cavities the ova are deposited, and thickly arranged, looking as if they were vaulted with a pavement of round stones. As the ova are of a beautiful and bright amber-colour, with a highly polished surface, they have a very brilliant appearance as the light falls upon them in their dark recess. They are semi-circular in form, and about one-tenth of an inch in diameter. Having succeeded in hatching them, I proved them to belong to the Common Shanny (*Blennius pholis*). This opinion of their character has been repeatedly confirmed, as it is the habit of this fish to retire beneath stones, or to crevices of the rock, during the recess of the tide, where they remain dry until the sea returns. By enlarging the openings of the cavities, I have generally succeeded in capturing the adult animal at the

farthest part of the chamber, and on one occasion found it depositing the ova."

We have already (see p. 24) mentioned the *Phycis* (φυκίς) of Aristotle, a Mediterranean species of this Family, as exhibiting a parallelism of instinct to the above, forming a nest of seaweeds, in which the spawn is deposited, and the young are tended by the parent fishes.

FAMILY XV. LOPHIADÆ.

(*Frog-fishes.*)

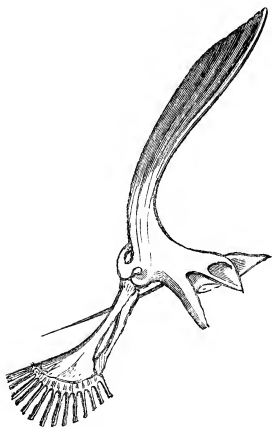
So exclusively are fishes in general inhabitants of the water, that it excites our surprise and admiration to see any species emerging from that element, and voluntarily taking to the earth or to the air. Among the Mammalia, there is one extensive Order, which is ærial, that of the Bats; and one which is exclusively aquatic, that of the Whales and Dolphins; while there are some members of the other Orders, which, in a less degree, emulate the habits of these respectively, as the volant Lemurs, Squirrels, and *Petauri*, on the one hand, and on the other the aquatic Shrews, the Otters, the Seals, and the Manatees. So among Birds, the terrestrial Ostriches, and allied forms, and the swimming and diving Penguins, are well-known deviations from the characteristic habits of their Class, and representatives of beasts and fishes. Reptiles again exhibit almost as many aquatic as terrestrial types; and not a few are arboreal, if not ærial, such as the Iguanas, the Anoles, the Dragons, the Chameleons, the Tree-snakes, and the Tree-frogs. But among

fishes, the law which assigns one sphere of action to the Class, is much more uniform in its operation, admitting of scarcely any exception.

This law is not, however, *quite* universal: there are a few fishes which invade the domain of the birds, as the proper Flying-fishes (*Exocoætus*), hereafter to be noticed, and some species (*Dactylopterus*) in the Family of the Gurnards; and in the *Lophiadæ*, the Family which we have now to describe, a still rarer aberration of habit is found in fishes which are enabled to leave the water, and crawl about on land, for hours, or even days

together, thus emulating the terrestrial manners of quadrupeds.

To enable them to do this, two peculiarities of structure have been conferred upon them: the one modifying the organs of motion, the other those of respiration. The pectoral and the ventral fins in fishes correspond with the limbs of other vertebrate animals, the former representing the arms,

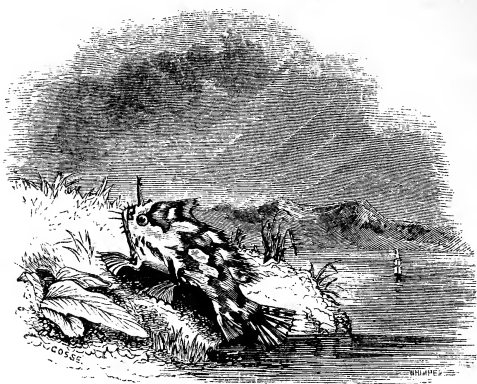


BONES OF PECTORAL FIN OF
LOPHIUS.

fore-legs or wings, the latter the hinder extremities. And this analogy, which is structural, is not at all affected by the relative position of these members, even though the ventrals should be, as in the Family before us, situated

considerably in advance of the pectorals. These latter then, representing the fore-legs of quadrupeds, are in the Frog-fishes so formed as to bear no slight resemblance, both in form and function, to feet. The bones of the wrist on which the fin is jointed are greatly lengthened, and projected beyond the skin of the body, and so closely resemble the bones of the fore-arm (the *radius* and the *ulna*), as to have been mistaken for them by a distinguished naturalist. The ventrals have a similar structure; and both are palmated in such a manner as to present a resemblance to the webbed foot of an aquatic fowl. The freedom given to the fins by their protrusion and their form enable them to be used as hands and feet; and the facility with which these fishes can crawl by means of their mimic limbs, we have personally witnessed in a little pelagic species of *Antennarius*, that inhabits the fields of floating weed in the gulf-stream of the northern Atlantic. Over the broad yellow surface of these floating fields, that look like parched meadows, the little Frog-fish crawls and disports itself, pushing aside the tangled stems with its foot-like ventrals, and clambering hither and thither with the energy and freedom of a quadruped.

But the power of crawling out of the water would be of little avail to a fish, unless it were endowed at the same time with some faculty by which its respiration could be maintained during its absence from the water, its breathing medium. In order to extract the oxygen needful for the revivification of the blood, it is indispensable that the minutely ramified filaments of the gills, the breathing organs, be kept moist, for



ANTENNARIUS.

“fishes,” as Professor Owen observes, “perish when taken out of water, chiefly by the cohesion and desiccation of their fine vascular branchial processes, through which the blood is thereby prevented from passing.”* Some fishes, as the Mackerel and Herring, are dead almost in an instant after exposure to the air; others, as the Eel and Flat-fishes, survive a long time: in the former, the gill-openings are enormously large, in the latter, they are very small. “The power of existing long out of water depends chiefly on mechanical modifications for detaining a quantity of that element in the branchial sacs,” and this is readily effected when the gill-aperture is small, for, “if sufficient water can be retained to keep the gill-plates floating, the oxygen which is consumed by the capillary branchial circulation is

* Lectures on Comp. Anat. ii. 260.

supplied to the water retained in the branchial sac, directly from the air.”*

Now in the Family before us the gill-rays and the operculum are enveloped in the common skin, and the aperture through which the breathed water is discharged is a comparatively small hole, situated behind the pectoral. This is small in all the Frog-fishes, but in those species (such as the genus *Antennarius* just mentioned), which are most addicted to roving out of their native element, the aperture is not only more than usually minute, but is produced into a short tube, which opens above each pectoral fin; and thus the gill-plates can be kept moist for an indefinite period of time.

Beautiful, indeed, are such combinations of structure and of function, such adaptations of part to part, and of organ to organ! They speak of the perfection of wisdom with which the whole of creation is formed; they loudly tell that one infinite Mind planned and executed the whole in all its details. Like the “glorious voice” uttered forth by the rolling spheres of heaven,—the testimony of the meanest fish that hides in the caves of ocean is heard “in Wisdom’s ear,” declaring—

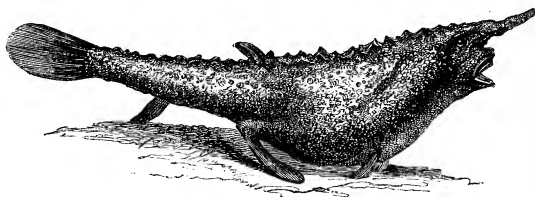
“The hand that made us is divine.”

These fishes have indeed little claim to outward elegance, either of form or colour. They are characterized by a thick, heavy body, sometimes compressed, sometimes depressed, often roughened, granulated, or covered with irregular tubercles, but always destitute of scales; the

* Professor Owen.

head is large, sometimes enormous; commonly grotesque or hideous in its aspect, armed with singular horn-like processes, or filaments; the eyes small, placed near the top of the head, usually with a vertical direction; the tails small and compressed; all the fins small.

It is to the thick, grotesque shape, naked tuberculous skin, often marbled with sombre colours, great head, and wide gaping mouth—common to these fishes—that they owe the names of Frog-fishes and Toad-fishes, by which they are familiarly distinguished. The accompanying figure of one of the constituent genera of the Family, (*Malthe nasuta*, Cuv.) will illustrate one of the forms, and show how appropriate is the reptilian designation conferred upon them. Nor is this



MALTHE.

at all an unfair specimen of the group; the other genera abound with species in which the aspect, external characters, and colours are so unlike those of ordinary fishes that an unscientific observer would be instantly reminded of a Frog or Toad.

The habits of these fishes have been already in part alluded to; some of the tropical species of *Antennarius* are so truly amphibious, as to come on shore, and crawl about in the fields for

two or three days at a time. Like the *Diodons*, which in some other particulars also they resemble, they have the habit of inflating the body by the inhalation of air until they are as round as a blown bladder; this is supposed to be principally done, when under the excitement of fear or anger. So tenacious of life are they that they have been transported alive from the tropical seas to Holland, where they were sold as high as twelve ducats a-piece.

MM. Cuvier and Valenciennes have, with much labour and skill, distinguished many species of this genus formerly confounded in the *Lophius histrio* of Bloch. The appropriateness of the appellation *histrio*, signifying a mountebank, for these fishes, has been misunderstood. It was meant to allude, not to any fancied activity or agility, a quality which they are very far from possessing in general, but to the peculiarity of their coloration, their hues, often diverse and strongly contrasted, being distributed in patches and irregular spots.

Yet some of the species have a certain agility. In the great estuaries that indent the northern coast of Australia, from which the tide ebbs far back in the dry season, leaving them broad flats of mud, there is one of these so abundant, and capable of taking such vigorous leaps, that some voyagers have mistaken them, at first sight, for flocks of birds.

It is doubtless an *Antennarius*, and perhaps this very species, that is thus described by Mr. Earl, as observed on the coast of Borneo: "Large tracts of mud had been left uncovered by the receding tide, and flocks of gulls and other birds

were feeding on the worms and small fish. Vast numbers of little amphibious creatures were running about in the mud, and they appeared to be sought after by some of the larger birds. They were from two to eight inches long, resembling a fish in shape, of a light brown colour, and could run and jump by means of two strong pectoral fins. On the approach of an enemy, they buried themselves in the mud with inconceivable rapidity, so that their sudden disappearance seemed to be the work of magic. One of the Malays was employed in catching them, as they are considered to be a great delicacy. He used for the purpose a thin plank, four feet long, and one foot broad; on one end of which were fixed several sharp-pointed nails, the points projecting beyond the end of the plank. He placed the plank flat upon the mud, and with the right knee resting on it, and kicking the mud with the left foot, he shot along the surface with great rapidity, the sharp-pointed nails transfixing the little creatures before they could succeed in burying themselves sufficiently deep to avoid it. This is a dangerous sport, and requires great skill in the fisherman to prevent accidents; for should he lose his plank, death would be almost inevitable, the mud not having sufficient consistence to support him without the aid of this simple contrivance.”*

About forty species, contained in four genera, compose this Family: they are all marine, and are found in both hemispheres, principally in the intertropical seas. A few inhabit the Mediterranean, and one is by no means uncommon around

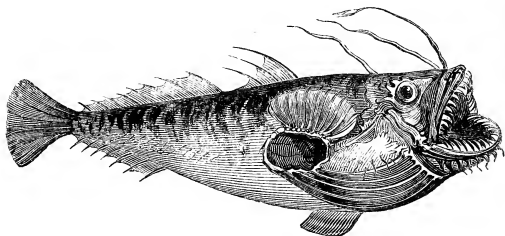
* Eastern Seas, p. 213.

the British Isles, and on the northern shores of Europe.

GENUS *LOPHIUS*. (LINN.)

The head in this genus is enormously large in proportion to the body, very broad, depressed, and spinous in many parts; the mouth is wide, deeply cleft, armed with teeth, differing in size, but numerous, sharp and incurved; the lower jaw fringed round with a series of free fleshy filaments. The tongue is broad; the gill-cavities are capacious, but open by a small aperture; the gill-rays are six in number. There are two dorsals, separated; the summit of the head is furnished with two or three bony filaments, jointed in a peculiar way to the skull, so as to be capable of free motion in various directions. Cuvier considers these as being, structurally, the first spines of the anterior dorsal. "In the Angler, or Fishing-frog (*Lophius piscatorius*, LINN.) of the British seas, the motions of these detached rays are very peculiar. Two are considerably in advance of the eyes, almost close to the upper lip; the posterior of these is articulated by a stirrup upon the ridge of the base, but the anterior one is articulated by a ring at its base, into a solid staple of the bone, thus admitting of free motion in every direction, without the possibility of displacement, except in case of absolute fracture. The third one, which is on the top of the cranium, behind the eyes, is articulated much in the same manner as the posterior one of the other two; and of course, though these two have considerable motion in the mesial plane of the fish,

they have very little in the cross direction. The one near the lip, however, can be moved with nearly the same ease and rapidity in every direction; and while the others terminate in points, it carries a little membrane, or flag, of brilliant metallic lustre, which the fish is understood to use as a



FISHING FROG.

means of alluring its prey; and the position of the flag, the eyes, and the mouth certainly would answer well for such a purpose.”*

The fact that the fish does use these long filaments as baits to attract the fishes which are to become its prey, seems to be indubitable, and has been known ever since the days of Aristotle. At that early period the instinctive stratagem had secured for it the name of Fisher, and the terms Fishing Frog, and Angler, by which it is known with us, commemorate the popular opinion of its powers. The absence of an air-bladder compels the *Lophius* to be a ground feeder, nor does it seem able to float freely at any depth without effort as many fishes do, or to do more than rise to the surface by the impulse of its fins, sinking as soon as the muscular effort is intermitted. Its

* Mudie, in Cuvier's Animal Kingdom, (London, 1840) p. 308.

habitual place is on the muddy or sandy bottom, on which its flattened form lies close. While lying thus, it stirs up, by the action of its pectorals and ventrals, the mud around, and thus renders the water turbid. Under the concealment thus formed, it moves hither and thither its coronal filaments, and especially that one which bears a little silvery flag; which, glimmering through the cloudy water, attracts other passing fishes towards it, actuated either by curiosity or appetite. The upturned eyes of the Angler mark the success of his strategic art, and a sudden lifting of his capacious mouth engulfs the unsuspecting victims.

The voracity of this fish is very great; in fact it seems to be composed of little else than mouth and stomach. Montagu says of one, that when suspended by the head, the contents of the stomach were readily seen, viz., by looking into the mouth and down the throat. The same naturalist remarks, that when the Angler finds itself a captive in the fishermen's nets, its appetite is by no means affected by its misfortune; for it proceeds immediately to devour its companions in captivity. Fishes thus swallowed are not infrequently taken from its stomach still alive, especially those which are tenacious of life, such as the flat-fishes. Its own flesh is not held in sufficient estimation to make it any prize on its own account, but the frequency with which other fishes, more valuable than itself, are found uninjured within its stomach, renders its capture not without value.

An example of its voracity has already been quoted in the earlier pages of this volume; and

Mr. Yarrell's beautiful work on British Ichthyology contains other instances, recorded on the authority of Mr. Couch, of the blind, indiscriminate appetite of this species. From these and other facts, it would appear that the Fishing Frog is in no wise delicate in his taste, and that he may be characterized as a glutton rather than an epicure. The amount of mischief done by such a gourmand on a fishing-ground must be enormous; especially as it is by no means uncommon to capture a dozen at once, and from their habits probably few are taken compared with the numbers that are present.

On the Scottish coast, this species is called Widegab, and Sea-devil. It is sometimes met with four, and even five feet in length. The body is not marked with the diverse hues common in the Family, the upper surface of the head, body, and fins being of a dark brown, nearly uniform in tint; the under surface of the same parts pure white. The eyes are brown, devoid of the metallic brilliancy so general in fishes.



FAMILY XVI. LABRIDÆ.

(Wrasses.)

In this very extensive Family we find great brilliancy and variety of colour, perhaps even in a higher degree than in the Chætodons. The richest greens, purples, blues, yellows, and reds of all degrees of intensity, in various combinations, are the common hues of the Wrasses, especially of those which inhabit the warmer seas; but the shores of Britain and those of southern Europe produce not a few, which shine in gorgeous tints, unfortunately as evanescent as beautiful. Some shade of green is perhaps the most common ground-colour, and the other hues are usually disposed in the form of spots or of longitudinal bands.

Little skill suffices to recognize the Wrasses. Their body is oblong, and spindle-shaped, clothed with rather large scales, which do not extend upon the fins. They have a single dorsal which is lengthened, partly spinous, partly flexible; the spinous rays commonly shorter than the others, and terminated by membranous filaments. The jaws are covered by fleshy lips, often thick and prominent, whence the name of the principal genus has been derived, *Labrus* from *labrum*, a lip. There are three bones in the *pharynx* (or throat), all of which are furnished with teeth, sometimes arranged like the stones of a pavement, sometimes pointed, or in laminæ; but generally conspicuous, and stronger than is customary in fishes. The intestines are either destitute of *cæca*, or are furnished with two small ones: a

swimming bladder is present, simple in structure, strong, and large.

About five hundred species are comprised in this Family, of which just one-fifth are European: the remainder are scattered over the shores of both hemispheres, most abundantly between the tropics. Around the spicy islands of the magnificent Oriental Archipelago, among the numberless kays and rocks of the Caribbean Sea, and especially in the clear and tranquil lagoons that abound in the coral-girt islets of the Pacific, the Wrasses, or Rock-fishes are exceedingly numerous, generally of small size, but of the most vivid colours. It is delightful to glide along in a boat over the surface of these calm waters, and peep down into the rocky chasms below, through an element scarcely less transparent than the air above; to see the corals and madrepores growing in a thousand fantastic forms, mimic shrubs of contorted slender branches, irregular wavy foliations, honey-combed masses of delicate laminæ, all of stone; great round brainstones with sinuous meandering furrows, all full of life; broad sea-fans of yellow and purple waving to and fro; sponges of curious shapes, and other forms of animal existence at its very lowest scale. Over these semi-animate masses other creatures are crawling; sea-urchins with long spines all quivering and vibrating with irregular and independent motion; star-fishes, with snake-like, slender tails; and beautiful shells half enveloped in the soft fleshy mantle that glows with rainbow tints, as each slowly creeps along. Twining about the tufts of living stone, now hiding in the cavernous recesses, now emerging, are seen multitudes of

strange annellidous creatures, like worms and leeches, many of them banded with contrasting colours, and displaying tufts of diverging filaments resembling gorgeous flowers. Crabs with painted shells, or horrid with bristling spines; transparent shrimps studded with spots of rich and vivid colour, violet and crimson, and other crustacea of the strangest shapes, are running, swimming, and darting hither and thither; and over all play hundreds of little fishes, sparkling in the rays of a tropical sun.

Many of these are indolently floating near the surface, enjoying the warmth of the sun, motionless except that a gentle undulation of the pectorals is perceived, whereby they are enabled to maintain their equilibrium. Some with a rapid vibration of the caudal fin are shooting swiftly to and fro, leaving a long sparkling wake behind them; and others are lying half concealed beneath the projecting ledges of the rocks. But scores are more actively engaged; they are browsing on the tips of the twigs of the newly formed coral, and gnawing at the surface of the madrepores. We see them approach and try one part after another, apparently smelling at it, rejecting some and testing other portions, with epicurean gusto, nibbling here and there, and now, having found a dainty part, grinding it down with their strong teeth in right earnest. These are principally members of the Family before us, the little gaily-tinted Rock-fishes, feeding, as is their wont, upon the growing corals. The gelatinous polypes that deposit the stony secretion are so protected by the latter, that it would be impossible to get at them without

grinding away the whole calcareous surface ; but to the powerful jaws and teeth of the *Labridæ* this is an easy task ; it is soon reduced to a pulp, and deposited in the stomachs of these fishes, where the nutritive matter is digested, and the stony residue rejected. Some of the genera have the power of protruding the mouth, and some (as the genus *Epibulus*) can impart a see-saw motion to the maxillary bones, analogous to that peculiar action of the jaws in the *Rodentia*, whereby they are enabled to gnaw away the hardest substances on which they feed, and probably here answering a similar end.

The beauty of these fishes is their only recommendation to man ; their flesh is, for the most part, soft, and in no estimation as food.

We may consider the *Labridæ* as constituting three sub-families, distinguished by the following characters.

1. *Labrina*. In the typical group, the lips are very thick and fleshy ; they are double, one lip adhering immediately to the jaw-bones, the other to the sub-orbitals. The teeth in the jaws are conical, those in the pharynx cylindrical, arranged like a pavement ; the upper ones with two large plates, the under with one only, which fits to the others. The cutting teeth are sharp, simple, and distinct, those in front are the largest. The gills are thickly set, with five rays. The ventrals and pectorals are small. About three hundred species are enumerated as belonging to this group, which includes all the *Labridæ*, thirteen in number, found on the British coasts.

2. *Chromidina*. In many of their characters the members of this group resemble those of the

preceding. They are distinguished, however, by having teeth resembling those of a card, except a range of conical ones in front. The operculum is scaled, the pre-operculum smooth. The pectorals and the ventrals are greatly developed; the former generally, the latter invariably, long and pointed, and sometimes produced into threads: the dorsal also sends forth thread-like filaments. About eighty species constitute this sub-family, which are almost exclusively natives of India. There is, however, a small species in the Mediterranean, and one (*Chromis Niloticus*, Cuv.), which, contrary to the habits of the family, is fluviatile, and reckoned the best fish in the Nile.

3. *Scarina*. The jaws, (*intermaxillaries* and *pre-mandibles*) are convex, rounded, and furnished with scale-like teeth on their margin and anterior surface. The jaws themselves resemble great teeth, and actually perform the office of teeth, being very thick and sharpened at the edges. These rounded bones are divided in the middle by a narrow line, and move vertically, independently of each other, as we have noticed in the living fish. They are nearly covered with fleshy lips, but there are no sub-orbital lips, as in the *Labrina*. The head and crown are usually elevated, the profile abrupt, sometimes vertical. The body is oblong, covered with coarse, horny scales, which are generally much larger on the tail than elsewhere. The caudal is for the most part crescent-shaped; the lateral line is interrupted. About one hundred and twenty species belong to this sub-family; scarcely any of which are found beyond the tropics. They are known as Parrot-fishes, chiefly on account of their rounded

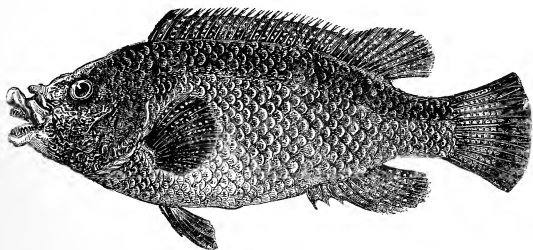
enamelled jaws, resembling the mandibles of a Parrot's beak, and partly perhaps on account of their vivid colours, in which respect they are in no wise inferior to the Wrasses proper. The flesh of these is eaten.

There is one species in the Mediterranean (*Scarus creticus*, ALDR.), which, after much investigation, Cuvier has concluded to be the *Scarus* so celebrated among the ancients, that, during the reign of Claudius, Elipertus Optatus, the Roman admiral, undertook an expedition to Greece, in order to procure it for distribution, with a view to its naturalization in the Italian seas. It is of a blue or a red colour, according to the season; and still inhabits the waters of the Grecian Archipelago, where it is eaten in its trail, like Surmullet with us. In the West Indies there are numerous species of great beauty; the flesh of these is eaten, though it is reputed to be peculiarly liable, at certain seasons, to assume that poisonous quality which we have described in a previous page, as characterizing the flesh of the Barracoota.

GENUS *LABRUS*. (LINN.)

In this extensive genus the operculum is scaled, the pre-operculum naked; both are destitute of spines or notches. The outline of the dorsal fin is nearly straight, or only slightly hollowed, between the spinous and the soft rays; the former are more numerous than the latter, and are furnished each with a short membranous filament behind its points; the caudal and the pectorals are rounded; the jaws are but slightly protrusile.

None of our native fishes can compete with the *Labri* for richness and variety of colour; though in elegance of form and changeable opaline splendour, the Mackerel is still their superior. Orange and blue of great brilliancy are the prevalent colours, generally arranged in stripes, but interchanged with green, lilac, and other colours. The rich tints of blue are considered to be in some measure dependent on the health and high condition of the fish; and are liable to vanish with remarkable rapidity when the body is immersed in spirits. But the bright colours may be retained, as it seems, by a different mode of preservation; for Donovan speaks of specimens of the rare and lovely *Labrus lineatus*, in his possession, in which the natural colours were admirably well retained. The skin in this case had been removed, and divested of the flesh with great care, while perfectly fresh, and then well prepared.



BALLAN WRASSE.

The largest species we have on our shores is the Ballan Wrasse (*Labrus maculatus*, BLOCH), of which the rare little fish just mentioned is,

by some naturalists, considered as the young. It attains the length of eighteen inches, and is rather thick in proportion. The colours are subject to some variation, but in general may be thus described. The ground-colour of the body is blue-green, darker on the upper parts, and paler on the lower; the scales, which are of large size, have orange-coloured margins, more or less wide: the head and cheeks are green with irregular lines of orange, and the thick lips are flesh-coloured. All the fins have red rays, and the intervening membranes spotted with fine greenish blue.

Such were the colours carefully noted down by Mr. Yarrell, of a fine specimen sent to him from Berwick; but one equally large from Swansea, described by Mr. Dillwyn, had a very different appearance. "The colour was red, becoming pale orange on the body; the body ornamented with bluish-green oval spots; the fins and tail green, with a few red spots; the dorsal-fin had spots along the base only." This discrepancy would depend on the greater or less width of the orange margins of the scales, in the former case the green hues, in the latter the red, predominating; while it serves to give a notion of the difficulty experienced by naturalists in determining the species of this charming Family, arising from the variableness of their coloration.

The habits of the European Wrasses appear to agree with those of their congeners in sunnier seas. The vast reefs and marine shrubberies of coral, with their innumerable animalcules, are indeed wanting in our northern latitudes, but still our rocks are inhabited by multitudes of soft-

bodied animals, mollusca, naked and shelled, and crustacea, which afford to these fishes ample sustenance. Mr. Couch's account of the habits of the Ballan Wrasse is probably applicable, with little variation, to all the species. "It frequents deep gullies among rocks, where it shelters itself among the larger kinds of sea-weeds, and feeds upon crabs and other crustaceous animals. It takes a bait freely, and fishermen remark that when they first fish in a place, they take but few, and those of large size; but on trying the same spot a few days after, they catch a greater number, and those smaller: from whence they conclude that the large fish assume the dominion of a district, and keep the younger at a distance. The spawn is shed in April; and the young, scarcely more than an inch in length, are seen about the margin of the rocks in shallow water, through the summer."

Some of the smaller species are occasionally taken in the wicker pots or creels set for crabs and lobsters; these, being baited with pieces of decaying flesh, or the offal of fishes, are sunk in shallow water, and not unfrequently attract small fishes to enter through the openings made by elastic converging points; entrance is easy enough, for the slender twigs yield to the pressure of the eager fish, but no sooner has it entered than these spring back to their former position, and present nothing but a close-set array of sharp points, which effectually preclude the hope of exit.

They are of little value, however, when caught; their flesh is soft and ill-flavoured, and consequently the fishermen do not in general bring them to market, but cut them up to bait the

crab-pots, in which they have been taken. Their beauty, it is true, occasionally secures them a place on the fishmonger's stall, when the specimens, at least of the rarer species, are pretty sure to be soon snatched up, not for the table, but for the shelves of some museum.

FAMILY XVII. FISTULARIADÆ.

(*Spinous Pipe-fishes.*)

Some of the *Labridæ* have the faculty of protruding the mouth so excessively as to form a tube; and there is one genus, the Green Wrasses (*Gomphosis*), of Ceylon, in which the mouth is not protractile, but the bones are lengthened into a permanent slender tube, at the extremity of which is placed the mouth. Thus we are prepared for the very limited but very curious and interesting family of tube-mouthed fishes before us. It has, however, other analogies, among the soft-finned fishes; as in the curious genus *Mormyrus*, found only in the Nile, considered by Cuvier, as allied to the Pikes, which have a small mouth set at the end of a slender tube; but especially in the *Syngnathidæ*, perhaps the most interesting of the whole Class, for the singularity of their organization and economy, in which the bones of the face are prolonged into a tubular snout, so similar to that of the present Family, that both alike have received the popular appellation of Pipe-fishes.

The *Fistulariadæ*, then, are characterized by having the face prolonged into a slender tube projecting forwards, composed of elongations of

the following bones:—the *ethmoid* (or anterior wall of the skull*) the *vomer*, (or central bone of the roof of the mouth) the *pre-operculum* and *inter-operculum*, (the anterior parts, above and below, of the gill-cover) the *pterygoids* and *tympanals*, (bones which help to form the cheeks). At the extremity of the osseous tube thus formed is placed the mouth, composed of the bones of the palate and the usual jaw-bones. In addition to this strongly marked character, it may be observed that the ribs are very short, or altogether wanting, and that the intestinal canal is short, comparatively free from irregularities and from windings.

This small Family, scarcely mustering twenty species, contains two peculiarities of form, the types of two sub-families.

1. *Fistulariana*. In these the body is long and slender, with the head about one-third of the whole length. They have six or seven gill-rays; with some bony appendages behind the head, to strengthen the fore parts of the body. There is but one dorsal, situated far back, immediately above the anal; the stomach is a fleshy tube merging into a straight canal, with two *cæca* at the commencement. These are the little fishes frequently brought home as curiosities from the tropical parts of the Atlantic and Pacific, and called Tobacco-pipe fishes. There are eight species enumerated, but they are of no use to man.

2. *Centriscina*. The mouth-tube is slender and cylindrical, and the body is oval or oblong, not

* Professor Owen, (Comp. Anat. ii. 104.) It helps to support and protect the organs of smell.

lengthened, flattened sidewise, and coming to an edge along the back. They have only two or three gill-rays, which are slender. There are two dorsals, the first strongly spinous, and both placed far behind; and small ventrals situated behind the pectorals. The mouth is very small and opens obliquely; the intestinal canal has two or three folds, but no cæcal appendages; there is an air-bladder of considerable size. Ten species are comprised in this sub-family, forming two genera; they are scattered over the Atlantic and Pacific Oceans; one is common in the Mediterranean, whence it occasionally wanders to the southern shores of Great Britain.

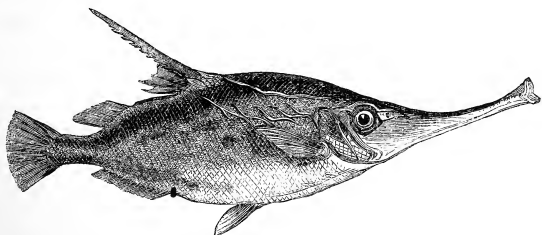
GENUS *CENTRISCUS*. (LINN.)

In this genus the form is short and compressed, the depth much exceeding the transverse diameter of the body; the head is not far short of half the whole length, much produced into a slender tube: the mouth, opening at the extremity, is very small, and destitute of teeth. The first dorsal is situated far back, and contains three or four spinous rays, of which the first is large and strong, connected by intermediate pieces with the bones of the shoulder and the skull: being thus supported, and very stout and strong in itself, and armed with a series of rugged teeth along its hinder edge, this spine forms a powerful weapon of offence and defence, capable of being moved at the will of the animal. The ventral fins are small and united. The body is covered with small scales, and with some larger toothed ones over the bony apparatus that connects the

dorsal spine with the fore parts. The under side of the body forms a sharp ridge, running along the abdomen.

Only one species is recognized, *Centriscus scolopax*, LINN., two or three specimens of which have been taken at different times on the southern coasts of this island. The earliest example recorded is that of one five inches long, which was cast ashore by the waves, in St. Austle's Bay, Cornwall, in the year 1804. It is commonly known as the Snipe-fish, or Trumpet-fish; and we learn from Mr. Yarrell's Synonymy, that in Cornwall it has received the title of Bellows-fish, an appellation pointing to its obvious similarity in form to that useful article of household economy, the caudal fin representing the handles, and the tubular snout the pipe, of the bellows.

The Snipe-fish rarely exceeds the size of the



SNIPE-FISH.

specimen already mentioned. When full grown the back is red, somewhat paler on the sides, and passing into silvery white, tinged with gold-colour, on the belly. All the fins are greyish-white. The young are of a brilliant silvery lustre, without the

red hue. The eyes are large and conspicuous; the irides are silvery, streaked with red, and the pupils are black. The scales are hard and rough, granulated on the surface and beautifully ciliated, or cut into very delicate filaments on the hinder edge.

Little is known of the habits of this singular little fish. According to Risso, it prefers a muddy bottom in moderately deep water, spawning in spring. The young are seen near the shore of the Mediterranean in autumn, shining with the silvery gleam already alluded to, they not having yet acquired the rich hue of the adult state: they are not numerous, and do not wander far from the locality in which they are bred. We have, however, seen the Snipe-fish under circumstances which seem to imply very different habits from these. In a recent voyage to Jamaica, when about one hundred and sixty miles south west of Madeira, a little *Centriscus* was taken alive in a bucket of water drawn from alongside; and on the same day a Bonito (*Thynnus pelamys*) was caught, the stomach of which was filled with these Snipe-fishes. The Bonito is well-known to be a surface-swimming fish; and his morning meal having been exclusively made of the *Centrisci*, combines with the specimen taken in a bucket, to prove that the latter also is a surface species, while the locality shows it to be pelagic. As all the individuals were alike in size, and none exceeded two inches and a half in length, it may have been a species distinct from the *C. scolopax* of the Mediterranean.

The food of the Snipe-fish is not recorded by naturalists: Mr. Yarrell, however, speaking conjecturally, says, "it probably consists of minute

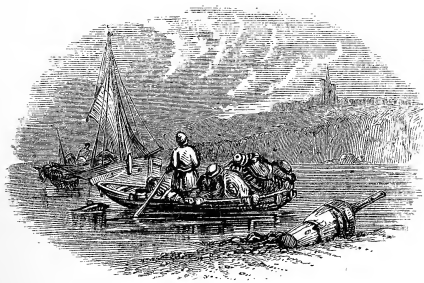
crustaceous animals; and in reference to the tubular mouth, it is probable that by dilating the throat, these fishes can draw their food up their cylindrical beak, as water is drawn up the pipe of a syringe. The beak-like mouth is also well adapted for detaching minute animals from among the various sorts of sea-weed. The flesh of the Trumpet-fish is considered good."

The natural history of Fishes is very meagre, as compared with the other branches of Zoology. We have exceedingly few of those details of manners, those narratives of instinctive actions, those accounts of curious contrivances and stratagems by which the great purposes of animal life are fulfilled, those delightful anecdotes of individual biography,—that throw such a charm over the history of other Classes of Vertebrate animals. Yet we doubt not that there exist abundant materials for such narratives, could we but get at them; the observations very recently published on the nest-making habits of certain fishes, long familiar to us, but hitherto unsuspected of any such instincts, intimate to us that this Class of living beings is not destitute of those endowments which so beautifully illustrate the inexhaustible resources of wisdom and beneficent power that belong to God, and which are seen in endless variety in those creatures which are patent to our observations. A great, and we fear insuperable, difficulty which the naturalist meets with in prosecuting his investigations into the manners and economy of Fishes, is the nature of the element in which they live. Even the common species of our rivers and ponds

are secluded from observation for the greatest part of their time, the depth of only a few feet of water precluding the possibility of our watching them with that care and perseverance necessary for the ascertaining of facts; while the desire of retirement manifested by these in common with most animals for the carrying on of the most important and interesting offices of their economy and instinct, combined with their timidity, prompts them to dwell in holes and caverns in the banks, or beneath the shelter of stones, or among the dense beds of waving weeds, or in the ooze and mud of the bottom, where the eye of the most patient and experienced observer can but now and then obtain a momentary glance at their forms, but is absolutely interdicted from perceiving what they are doing.

If this be true of our common lacustrine and fluviatile fishes, how much more applicable is it to the thousands which are marine, and especially to those which are pelagic! Who can penetrate into the depths of ocean to trace the arrowy course of the mailed and glittering beings that shoot along like animated beams of light? Who can follow them to their rocky beds and coral caverns? The wandering mariner sees with interested curiosity the Flying-fish leap in flocks from the water, and the eager Bonito rushing after them in swift pursuit; but who can tell what the Flying-fish is doing when not pursued, or how the Bonito is engaged when the prey is not before him? How many pleasing traits of conjugal or parental attachment the waves of the fathomless sea may conceal, we know not: what ingenious devices for self-protection; what structures for the concealment of

eggs or offspring; what arts of attack and defence; what manœuvrings and stratagems; what varied exhibitions of sagacity, forethought and care; what singular developments of instinct;—who shall tell? A few examples of these we are acquainted with, some of which have been, and others will be, mentioned in this volume;—but these have become known more by accident, “the fortune of the hour,” than by research; and while they possess an enhanced interest from their rarity, they rather tend to whet and tantalize our curiosity than to satisfy it, confirming the presumption that such facts are not uncommon among fishes, though they do not much encourage our hopes of ever being able to draw aside the veil that conceals the chief part of the economy of this important Class of animals from the observation of man.



ORDER II. MALACOPTERYGII.

(*Soft-finned Fishes.*)

THE skeleton in the members of this Order is, like that in the preceding, formed of bone. Their fins are, however, supported by flexible, jointed, and branched rays. "This," says Mr. Swainson, "is the chief typical character, and the exceptions are very few. In some, as in the *Siluridæ*, the first rays of the dorsal and pectoral fins are represented by bony spines, the sides of which are crenated, or toothed, like a saw. In the Flat-fishes (*Pleuronectidæ*) the rays are semi-spinous; and even among the most typical Families, the first two or three dorsal rays are rigid: yet all these deviations take not from the fact, that the whole of these fishes are known by the absence of spiny rays, *placed after the first or second*, in any of their fins."*

In addition to this character it may be observed that, with few exceptions, the gill-openings are unconfined, and the gills have the structure common to the ACANTHOPTERYGII, of fringes resembling the teeth of a comb.

The Soft-finned Fishes are, in general, inferior to the Spinous-finned in the degree of development of those essential characteristics which distinguish a fish from other vertebrate animals: they are a step lower in the scale of organic per-

* Monocardian Animals, i. 226.

fection. The great majority of fresh-water fishes are found here, though associated with many that are exclusively marine. A considerable proportion of the species are ground-feeders; fishes which have the powers of swimming feebly developed, and are compelled to grovel on the mud at the bottom, and lie in wait for passing prey. An example of this kind we saw in the Frog-fishes, among the Spinous-finned Order, but this is an exception to the general habits of that energetic group, and indeed is by some zoologists excluded from its pale.

The Order before us is surpassed by the preceding in elegance of form and brilliancy of colour. Not that it is absolutely deficient of either; the Herrings afford examples of the former, and not a few of the great Salmon Family exhibit both qualities in high perfection; but, generally speaking, they are not prevalent in the Order. In a property, however, of much greater importance, their utility in contributing to the sustenance of man, the Soft-finned tribes vastly surpass all the other Orders of Fishes put together. Among the marine species, the various kinds of Herring, Pilchard, Sprat, and Shad; the Cod, Whiting, Pollack, Hake, Ling, and Barbot; the Plaice, Dab, Flounder, Halibut, Turbot, Brill and Sole;—among the freshwater species, the Carps, Barbel, Tench, Bream, Roach, Dace, and Chub; the Pike; the Eels; the various kinds of Trout and Salmon, the Char, the Gwyniad, and the Pollan, including their varieties and kindred species, may be mentioned as being all of more or less value to man. Many of these, as is well known, are the subjects of important fisheries, the sources of

employment to myriads of industrious people, and the fountains of commercial wealth to towns, districts, and even nations; of these we shall have to speak somewhat in detail.

In general there is but one dorsal fin present in this Order: some of the Cods indeed are described as having three, but we rather incline to consider these as divisions produced by interruptions of continuity in one lengthened fin; just as the finlets in the typical Mackerels are structurally nothing more than the posterior portions of the second dorsal and anal cut into notches. The Salmons have a minute second dorsal, commonly called the *adipose*; but it is not a true fin in structure, being only a lamina of fat inclosed in a fold of skin, quite destitute of rays.

The most singular aberrations of form and function that we meet with in this Order are found in the Flying-fishes, and in the Flat-fishes. The former, by an enormous development of some of their fins, are able to take long flights through the air like birds: the latter have a most remarkable contortion of the body, whereby the usual symmetry of form and organs and colour is lost. Both of these peculiarities will require special notice in their proper order. The large Family of the Eels also presents interesting peculiarities.

As in the Acanthopterygian Order, we give from the Prince of Canino's Synopsis a list of the twelve Families included in the MALACOPTERYGII, with the number of species included by him in each Family, at the time (1831) when it was published. As we go through the Families in course, we shall mention the number of species assigned

to each by the same authority in his recent *Conspectus*, published in 1850. Thus it will be seen how rapid are the accessions that are now being made to our knowledge of the species of animals.

	SP.		SP.
1 Cyprinidæ	266	7 Pleuronectidæ	77
2 Esocidæ	72	8 Cyclopteridæ	27
3 Siluridæ	128	9 Echeleidæ	4
4 Salmonidæ	148	10 Ophidiadæ	16
5 Clupeadæ	103	11 Murænadæ	75
6 Gadidæ	41	12 Syngnathidæ	43
		Total 1000	

FAMILY I. CYPRINIDÆ.

(*Carps.*)

In this very extensive Family, comprising so many of our well-known and familiar river-fishes, the mouth is small and shallow; the jaws are feeble and destitute of teeth; but the pharynx (or entrance of the gullet) is defended by strong teeth which compensate for the feeble armature of the jaws: the tongue is smooth. The form is somewhat compressed, and symmetrical; the body covered with scales, which are generally large; the fins are destitute of scales; the rays are soft, the membrane somewhat opaque: there is but one dorsal, generally placed near the centre of the back: the gill-rays are few in number. The stomach is continuous, and the intestine is not furnished with any cæcal appendages.

The Carps are considered to be the most herbivorous of all fishes, feeding chiefly on the seeds

and roots and half-decayed leaves of sub-aquatic vegetation; and even, as is asserted, (though probably on insufficient evidence,) swallowing the ooze and sludge deposited at the bottom of ponds, for the sake of the organic matter contained in it. The typical genera are well furnished for the bruising and grinding down of tough vegetable tissues, possessing in the armed pharynx a powerful instrument of mastication, which we shall presently describe more fully. The majority of species have thick fleshy lips, sometimes furnished with short *cirri* or tentacles, and a thick, soft appendage to the palate, well known by the erroneous appellation of "Carp's tongue," which being freely supplied with nerves of sensation, is doubtless endowed with a delicate perception.

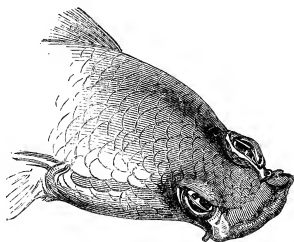
Mr. Swainson sees an analogy between this Family and that of the Eels, which he instances in the following particulars: the possession of thick, fleshy fins; the mucous slime with which their bodies are clothed; the absence or paucity of proper teeth, and the vegetable nature of the diet. The resemblance, however, appears to us but slight, and counterbalanced by much more numerous and more important points of dissimilarity:—while in one of the particulars enumerated the analogy fails egregiously; for the Eels are as indiscriminately voracious as the Carps are abstemious.

This is the most numerous in species of all the Families of Fishes, containing, according to Prince Bonaparte's late *Conspectus*, the immense number of seven hundred and twenty-three. This, however, includes the Loaches of the Old and of the New World, of which that

zoologist makes two distinct Families. We prefer to consider them as Sub-families.

1. *Pæciliana*. In this group, the head is flat, the jaws are broad, and flattened horizontally, with a very small mouth, furnished with one or more rows of very fine teeth; the gill-openings are large, with, in general, five gill-rays; the body is rather short, and clothed with large, strong scales. This Sub-family comprises about fifty species, which chiefly inhabit the rivers of America. One little species is found in Sardinia, and another (*Cyprinodon umbra*, LACEP.) is remarkable as being one of the inhabitants of those subterranean lakes in Austria where perpetual darkness reigns.

Another species, still more interesting, as if to make a superabundant use of the light which the former is destined never to see, has the organ of



HEAD OF FOUR-EYED LOACH.

vision fourfold. It is the *Anableps tetraphthalmus*, commonly known as the Four-eyed Loach of the Brazilian rivers. This appellation is, however, only partially correct. "The eyes," observes Cuvier, "are prominent, placed under a

sort of roof formed by the side of the frontal bone; and the *cornea* and *iris* are divided by transverse bands, which give the fish the appearance of having four eyes, whereas in reality it has only two. *There are certainly two openings* to each eye, but still, in its essential parts, the organ is single; and whether vision is performed by the anterior or posterior opening, the same sentient organ is acted on." These remarks are confirmed by the observations of a recent naturalist, Mr. Edwards, who, in his delightful work, "A Voyage up the Amazon," thus speaks. "One curious species, the *Anableps tetraphthalmus*, was very common; it is called by the people, the four-eyed fish, and is always seen swimming with the nose above the surface of the water, and propelling itself by sudden starts. The eye of this fish has two pupils, although but one crystalline and one vitreous humour, and but one retina. It is the popular belief that, as it swims, two of its eyes are adapted to the water, and two to the air."*

It adds to the interest of this singular little fish, that it, as well as all the other species of this group, brings forth its young alive, and in a state of considerable advancement.

2. *Cobitina*. Here the head is small; the body lengthened, clothed with minute scales, and enveloped in a viscous slime. The mouth is very small, placed beneath the snout, without teeth, but having thickened lips, forming a kind of sucker, and furnished with numerous fleshy *cirri*. The gill-openings are small, and there are but three gill-rays. There is a small dorsal situated

* Voyage, &c., p. 50.

in the middle of the back; and the ventrals are placed just beneath it; the caudal is large and rounded, or truncate. The air-bladder is two-lobed, and is curiously inclosed in a case of bone, attached to the spine. There are twenty-two species known as Loaches, which are found in the fresh waters of the Old World, and chiefly in the rivers of India. Two, however, are British; and are among the most minute of our fishes, the one attaining the length of three inches, the other that of four. Though so minute, the flesh of the Loach is accounted excellent; and in some parts of Europe, so great is the estimation in which it is held for its exquisite delicacy and flavour, that it is often transported with considerable trouble and expense from its native streams, to such as flow through the estates of the opulent. Frederic I., of Sweden, imported our common species (*Cobitis barbatula*, LINN.), from Germany into his own dominions, where they were readily naturalized.

3. *Cyprinina*. In this Sub-family, which comprises an immense majority of the species, the small mouth, the jaws absolutely destitute of teeth, and the three flat gill-rays, are obvious distinctions, to which are added the palatal cushion, and the grinding apparatus in the *pharynx*. The tongue is smooth; the scales are usually large; the air-bladder is divided into two compartments by a narrow neck. There is but one dorsal, generally near the middle of the back. No fewer than six hundred and fifty species are enumerated in this group, which are principally inhabitants of the fresh waters of the Old World; a few are found in America; but only,

as far as we know, in the northern division, both of the one and the other hemisphere. Of this great host, one hundred and twenty-five species are marked by Bonaparte as European, and twenty are found, in greater or less abundance, in British waters. Austria and Prussia are the chief Carp countries in Europe, but the streams of temperate and southern Asia constitute the great home of the group.

Among the twenty native species are some of the fishes most familiar to anglers; such as the Carps proper (of which there are three kinds), the Gold-fish of our parlours and reservoirs, the grovelling and wallowing Barbel, the Gudgeon, the slimy Tench, the three kinds of Bream, the crimson-finned Roach, the silvery Dace and Grayling, the “logger-head Chub,” the golden Rudd, the Bleak, whose scales are used in making artificial pearls, and the brilliant little Minnow, the desire and delight of truant school-boys.

GENUS *CYPRINUS*. (LINN.)

The true Carps, which are numerous, have the lips fleshy and moderately thick, but not plaited nor notched; there are sometimes small *cirri* or tentacles at the corner of the mouth; the jaws are of equal length. The dorsal is lengthened, with the first and second rays bony; the second ray of this fin, as well as the first of the anal, is cut into strong teeth along its hinder edge.

The fleshy tubercles which are found attached to the lips of some of the Carps, occasionally produced into *cirri* or beards, and which, in the Barbels, an allied genus, are large and conspicu-

ous, are doubtless delicate organs of touch; and, being principally conferred on such species as habitually grovel on the bottom, they may be intended to compensate for the lack of light in such situations, as an aid for the discovery and trial of substances proper for food. The tongue, in most fishes, appears not to be an organ of taste; when it projects at all into the mouth, it is commonly covered with integuments, which are callous and void of sensitive papillæ,* or else these are hardened and sharpened into bony teeth, studding its surface, and denying the power of sensation. "The integuments of the palate, however, not unfrequently present that degree of vascularity, and supply of nerves, which indicate some selective sense, analogous to taste. In the Carps, the palate is cushioned with a thick, soft vascular substance, exuding mucus by numerous minute pores, but more remarkable for its irritable, erectile, or contractile property; if you prick any part of this in a live Carp, the part rises immediately into a cone, which slowly subsides; this peculiar tissue is richly supplied by branches of the *glosso-pharyngeal* nerves;† it may assist in the requisite movements of the vegetable food, as well as add to it an animalizing and solvent mucus, whilst it is undergoing mastication by the pharyngeal teeth."‡

These teeth themselves are interesting from their position and nature. The lower pharyngeal

* The minute pimples or wart-like eminences that thickly cover the human tongue, and give it its peculiar spongy appearance.

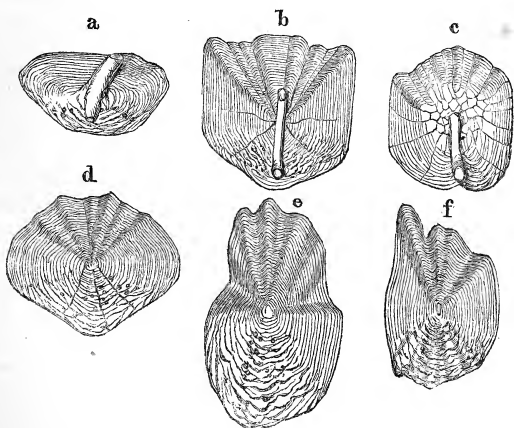
† The nerves which go off to the gullet, the back of the mouth and the tongue.

‡ Owen's Comp. Anat. ii. 230.

bones are set with stout teeth, forming, as it were, a pair of jaws at the entrance of the gullet; these are opposed by a great flattened disk of stony hardness, placed above them, and lodged in a cavity or socket in the base of the skull. Between these, the vegetable substances on which these fishes principally subsist, are strongly ground down, before they are transmitted to the stomach; and thus compensation is given for the entire absence of teeth in their more ordinary situation at the anterior orifice of the mouth.

The scales in the Carps have their free margins rounded and entire, and their front, by which they are imbedded into the skin, cut into sinuosities, but not toothed. The accompanying engraving represents scales selected from various parts of the Gold-fish, (*Cyprinus auratus*, LINN.) Figs. *a*, *b*, and *c*, are scales from the lateral line, the first taken just behind the head, the second in the middle, and the third near the tail. The lower part in the figures is the free portion, which alone is visible in the fish, the other part being concealed by the three neighbouring scales that overlap it, above, in front, and below. The tube before referred to, (see page 7), is seen to pervade each, running through a portion of it longitudinally, so that it opens posteriorly on the outer surface, and anteriorly on the inner or under surface of the scale. In the scales near the front of the line, the tube is large and prominent, (as in *a*,) while, in the very last scale at the opposite extremity, it is merely a groove. *d*, is a scale from the back; *e*, one from the middle of the belly, and *f*, one from the throat. The variety of form in the scales is illustrated by these figures, which

were all taken from the same individual fish, and their number might have been much increased. The whole surface of each scale, when viewed under a lens of low power, is seen to be covered with concentric lines, following the irregular sinuosities of the outline. These lines are the edges of the successive layers of which the scale is believed to be composed, each layer being added in the process of growth to the under



SCALES OF GOLD FISH (*magnified*).

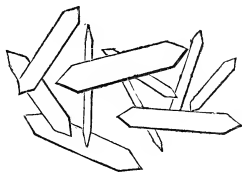
surface, and each being a little larger every way than its predecessor; thus the scale is a very depressed cone, of which the centre is the apex. There is a marked difference (indicated in the figures) between that part of the surface which is exposed, and that which is covered by the other scales; the concentric marks in the former

are much coarser and less regular, often being interrupted, and seeming to run into each other, and frequently swelling into oval scars. This may, perhaps, be owing to the surface having been partially worn down by rubbing against the gravel of the bottom, or against other objects in the water. Besides the concentric lines, there are seen on many of the scales, especially those of the lateral line, radiating lines varying in number from one to twenty or more, diverging from the centre towards the circumference, and frequently connected by cross lines forming a sort of network around the centre, (see *c*). Under the microscope these lines appear to be elevated ridges, dividing the concentric lines; but of their use we are ignorant.

In the microscopical examinations which we instituted while writing these pages, we ascertained some interesting facts. The brilliant golden or silvery reflection that constitutes the beauty of these lovely fishes depends not on the scales themselves, but on a soft layer of pigment spread over their inner surface, and seen through their translucent substance. On carefully detaching a scale, we see on the under side, opposite to that portion only which was exposed, all the concealed parts being colourless, a layer of soft gleaming substance, easily separable, either silvery or golden, according to the hue of the fish. If now we remove a small portion of this substance with a fine needle, and spread it on a plate of thin glass, we shall find, by the aid of the microscope, that it consists of two distinct substances; the one giving the colour, the other the metallic lustre. With a power of 300

diameters, the former is seen to be a layer of loose membranous cells of an orange colour, in what are properly called the Gold-fishes, and whitish or pellucid, in the Silver-fishes. If we now add a minute drop of water to the mass, and gently agitate it with the point of a needle, and again submit it to the microscope, we shall have a beautiful and interesting spectacle. The water around the mass is seen to be full of an infinite number of flat spiculæ or crystals, varying much in size, but of very constant form, a flat oblong prism with angular ends, as represented in the accompanying engraving. By transmitted light

they are so transparent and filmy as to be only just discernible; but by reflected light, and especially under the sun's rays, they flash like plates of polished steel. But what appears most singular, is that each spicula is perpetually vibrating and



SPICULÆ OF GOLD-FISH'S
SCALE.

quivering with a motion apparently quite spontaneous, but probably to be referred to slight vibrations of the water in which they float; and each independently of the rest, so as to convey the impression to the observer that each is animated with life, though the scale be taken from a fish some days dead. Owing to this irregular motion, and consequent change of position, each spicula, as it assumes or leaves the reflecting angle, is momentarily brightening or waning, flashing out, or retiring into darkness, producing a magic effect on the admiring observer. To this property, we

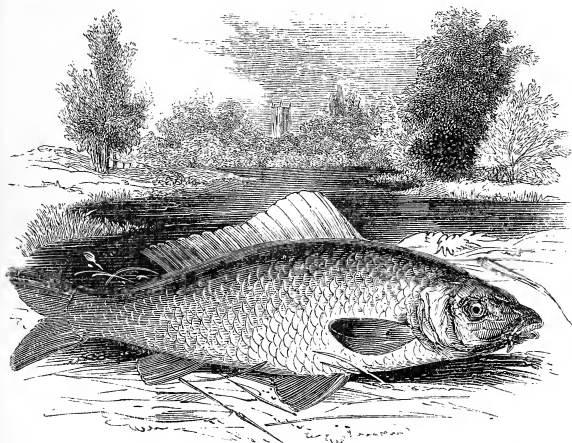
suppose, is to be attributed the beautiful pearly play of light that marks these lovely fishes, as distinguished from the light reflected by an uniformly polished surface. We have found the pearly pigment of the scales to be provided with similar spiculæ in fishes widely differing in size, structure and habits, as the Gudgeon and Minnow, the Pike and the marine Bream. The spiculæ of these fishes agree in general form with those of the Gold-fish, and also in size, with the exception of trifling variations in the comparative length and breadth. The colouring matter is lodged in lengthened cylindrical cells, arranged side by side, and running across the scale, that is, in a direction at right angles to the lateral line.

The Common Carp (*Cyprinus carpio*, LINN.), though not indigenous to England, is now sufficiently abundant here, especially in the southern and midland counties. In Scotland it cannot be considered other than rare. The period of the introduction of the species into this country is disputed; the probability is, that it was imported into different parts at separate times. The earliest notice of it on record is by Dame Juliana Berners, about the end of the fifteenth century.

The Carp has been known to attain the length of thirty inches, with a girth of twenty-two. Its colours are brownish-olive on the upper parts, and dull white on the lower, the whole surface having a tinge of yellow: the fins are dark brown; the number of their rays is as follows: D. 22; P. 17; V. 9; A. 8; C. 19. The scales are large and coarse; the lateral line nearly straight.

Still waters are principally affected by this species; ponds with soft muddy bottoms are most

favourable to its increase. It feeds greedily during open weather; but in the depth of winter buries itself in the mud, and lies inactive. It is easily familiarized to the sight of man, and may



CARP.

be taught to come to the shallows to be fed by hand. It will live a long time out of water, if kept moist and cool.

Carp are occasionally taken in nets in the Thames as large as nine, and even ten pounds each. The angling season opens at the beginning of June, but for the whole of that month the fish have hardly recovered from the exhaustion attendant on spawning, and therefore are scarcely worth the capturing. Towards July, they begin to afford excellent sport; thenceforward the river

is crowded with punts, and numerous anglers throng the banks, among whom may be seen many of the gentler sex. Gudgeon fishing is then the order of the day, and Chub, Roach, and all the coarser kinds of the *Cyprinidæ*, are taken in great numbers. Barbel fishing begins later, and continues vigorously prosecuted till October, when the coldness of the weather gradually puts a stop to all fishing until the return of genial spring.

The Carp is wary, and often tries both the angler's skill and patience. The small ones, however, may be caught readily, but the large ones seem to have learned wisdom, "long experience having made them sage." They avoid the baited hook and the net; the latter by sinking into the mud, and allowing it to be dragged over them. They delight in still water where there are aquatic plants with large leaves: they feed on worms, the larvæ of insects, the spawn of other fishes, and the shoots and tender leaves of water plants. It is recommended to sow grass-seed around the edges of ponds where Carp are kept.

"There is," says Mr. Jesse, himself a devotee of the gentle art, "a freshness, a repose, an indescribable enjoyment of solitude on the banks of a clear and placid river, which a lover of Nature can alone sufficiently appreciate. The air is so pure on a fine morning in the spring, her breath so sweet as it passes through the snowy hawthorn bushes, the sloping hills are so varied with trees and flowers, and the meadows so fresh and gay, that cold must that heart be, and insensible to the charms of river-scenery, that does not enjoy such a spot, and look around him with delight. Those

who have wandered on the banks of my favourite Avon, as it flows through the borders of the New Forest, and seen its clear and sparkling waters passing over the long and yielding rushes, which sometimes show themselves above the surface, and then gently hide themselves as some dragon-fly settles upon them,—those that have watched the graceful bendings of the stream, sometimes opening into shallow *broads* covered with *ephemeræ*, and then narrowing into deeper and more rapid channels, will have experienced the quiet enjoyment of the scenery of one of our most beautiful rivers. . . . It is to the honest and patient angler, that such scenes afford the greatest enjoyment and admiration. Far removed from the noise and turmoil of the world, he prepares his rod, and while standing on the banks of the stream, with the speckled trout rising freely around him, he ‘tastes the unrifled freshness of the air,’ and is thankful for the innocent enjoyment he is partaking of.”*

FAMILY II. ESOCIDÆ.

(*Pikes.*)

Fishes differing much from each other in outward appearance are associated in this Family; and, therefore, the characters by which they can be described are few. The single dorsal, placed far behind, and corresponding, both in form and position, to the anal, is the most obvious character, though not wholly without exception, for in *Microstoma*, the dorsal is rather before the anal.

* Jesse's Scenes of Country Life, p. 80.

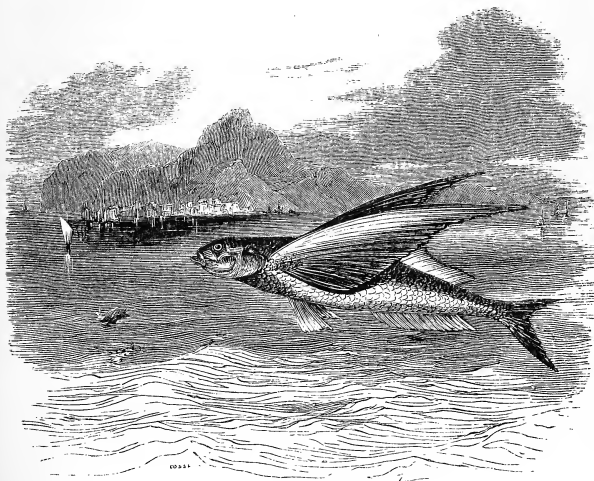
Generally the body is more or less lengthened, somewhat flattened on the summit of the head, and along the back: the mouth is commonly large, and frequently armed with formidable teeth. The intestine is short, and destitute of *cæca*; the swimming bladder is present.

About a hundred and twenty species constitute this Family; few of which are European. They are scattered, however, over the waters of both hemispheres; some are inhabitants of lakes and rivers, many are oceanic, and most are marine. They fall into two subordinate groups, Pikes and Flying-fishes.

1. *Belonina*. In this group, containing the Pikes, Gar-fishes, &c., the pectorals are of small size; the body is more or less lengthened; the muzzle much developed, either in breadth or length; the mouth widely cleft, and armed with numerous teeth. Great voracity is characteristic of these fishes. Beside the Pike, presently to be noticed, the most interesting forms in this division are the Gar-fishes (of which the British seas present three examples), remarkable for their lengthened eel-shaped bodies, and the excessive prolongation of one or both of their jaws into slender horny spears. Another singular genus is *Stomias*, whose widely cleft mouth is set with sharp and curved teeth, so enormously long, that when the mouth is shut, they project above and below, like immense tusks. In other respects also this is a curious form.

2. *Exocæтина*. Here the body is herring-shaped, but broader on the back: the pectorals are greatly enlarged, as are frequently the other fins also: the mouth is small, obliquely cleft; the teeth few

and minute; the eyes very large and prominent. By means of the enormous development of the pectorals, these fishes are enabled to project themselves from the water, and to perform a lengthened flight through the air. They are very common



FLYING-FISH.

in the tropical seas; vast shoals springing into the air almost constantly in fine weather. A straggler now and then wanders to our own shores. About forty species are enumerated.

GENUS *Esox*. (LINN.)

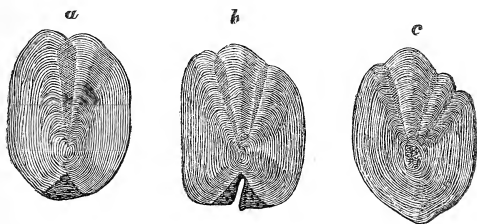
The freshwater Pikes have a moderately lengthened body with a large, oblong, rounded, flattened

head; a mouth deeply cleft, and armed on nearly the whole of its interior with minute teeth, besides a row of strong, long, pointed ones on each lower jaw. The body is clothed with small, distinct scales. But two or three species are known, inhabiting the fresh waters of Europe and North America. Of these the most celebrated is our own Pike or Jack, (*Esox lucius*, LINN.)

The body of the Pike is much lengthened, somewhat four-sided, with the single dorsal placed very far behind. The head is flat, and produced into a broad, rounded muzzle, bearing no small resemblance to a duck's beak, when viewed from above. The gills open far back, behind the pectorals; the eyes are placed near the top of the head. The general form of the head bears an analogy with that of the Crocodile's, nor do the strong and sharp teeth of the lower jaw diminish the resemblance. The colour of the upper parts is dusky olive, marked with close set rows of small silver spots, produced by the disks of the scales. The sides are mottled with yellow and grey, and the belly is white. The fins are dusky, the dorsal, anal, and caudal, clouded and spotted with dark brown and red. The lateral line is scarcely distinguishable; but is nearly straight. The eyes are pale golden.

The scales are rather small for the size of the fish; they are more or less rounded in outline, without any points behind, or any structure there differing from the other parts, the concentric lines, which are very fine and close, being continuous all round. The front edge has some radiating undulations, the usual number of which is three, though sometimes two, and sometimes four,

are seen on particular scales: the edges of these undulations actually overlap each other, a curious peculiarity of structure. The scales of the lateral line are not furnished with tubes as usual, but are simply cut with a deep narrow incision, through which an outlet is afforded to the mucus, with



SCALES OF PIKE.

which the body of this fish is so profusely lubricated. The above engraving represents scales from different parts of the body: *a*, is from the back, and has but two undulations; *b*, is from the lateral line, and has three; *c*, is from the belly, and has four.

The portrait of the Pike is drawn in the following lively, but not very flattering colours, by 'Ephemera,'—"He is a greedy, unsociable, tyrannizing savage, and is hated like a Bluebeard. Everybody girds at him with spear, gaff, hook, net, snare, and even with powder and shot. He has not a friend in the world. The horrible gorge-hook is specially invented for the torment of his maw. Notwithstanding, he fights his way vigorously, grows into immense strength, despite his

many enemies, and lives longer than his greatest foe, man. His voracity is unbounded; and like the most accomplished corporate officers, he is nearly omnivorous, his palate giving the preference, however, to fish, flesh, and fowl. Dyspepsia never interferes with his digestion; and he



PIKE.

possesses a quality that would have been valuable at La Trappe,—he can fast without inconvenience for a se'nnight. He can gorge himself then to beyond the gills, without the slightest derangement of the stomach. He is shark and ostrich combined. . . . His intemperate habits render him an object of disgust and dread. He devours his own children; but, strange to say, likes better, (for eating,) the children of his neigh-

bours. Heat spoils his appetite; cold sharpens it."*

A few examples of the indiscriminate voracity that characterizes this monster of the rivers, we select from the multitude that are on record.

A writer in the *New Sporting Magazine* asserts that on a summer evening he has more than once seen a brood of young wild ducks devoured by a Pike in the course of a few minutes. An unfortunate guinea-pig, that had died in giving birth to a litter of young ones, was thrown with its brood into a piece of water in which were many very large Pike, when the whole were seized and swallowed by one of these tyrants; an incident which gave the keeper occasion humorously to boast that he had seen a Pike which devoured at a meal *a sow with a litter of pigs*. At times this fish will ravenously seize almost anything that is offered it. In a small stream near London, a Pike lay basking near a cottage, when a gentleman walking round his garden saw it; he procured his rod and line, and for want of other bait desired the cook to cut him off a large slice of veal. With this he baited his hook, and dropping it gently on one side of the fish, the voracious creature instantly seized it, and was captured. It was found to weigh 12lbs.

The voracity of the Pike is shown by a circumstance of no infrequent occurrence in Sweden. Large Perch often swallow the baited hooks of stationary night-lines, and then enormous Pike gorge the hooked Perch in their turn. In this case, though the Pike himself is seldom or never actually hooked, yet on the fisherman's drawing in his line, the Perch sets so fast in the greedy

* Hand-book of Angling, 336.

throat of the finny tyrant that he has been unable to get rid of it, and both are taken. In some cases, however, the Pike, at the moment of reaching the surface, by means of a desperate lunge, relieves himself from his dangerous victim, and effects his escape.

O'Gorman gives some examples of the same ravenous appetite. One which he killed with a Roach for a bait, had in his maw a Trout of four pounds weight, evidently just taken; and another seized a Trout of more than six pounds. But these examples yield to what he says he witnessed on Dromore. A large Pike having been hooked and nearly exhausted, was suddenly seized in the water and carried to the bottom. Every effort was made for nearly half an hour to bring this enormous fish to shore, but to no purpose; at length, however, by making a noise with the oars and pulling at the line, the anglers succeeded. On getting up the Pike which they had been playing, it was all torn as if by a large dog, but really, doubtless, by another fish of the same species; and as the Pike so illtreated weighed seventeen pounds, the rapacious fish that had held it so long must have been indeed a monster! *

Mr. Lloyd informs us that it is not an uncommon thing in the North of Europe for even the voracious Pike to become the prey of a feathered enemy. Eagles frequently pounce on these fish when basking near the surface; but when the Pike has been very large, he has been known to carry the Eagle under the water; in which case the bird being unable to disengage his talons has been drowned. This traveller was informed by

* The Practice of Angling, i. 318.

Dr. Mellerborg, that he had himself seen an enormous Pike, with an Eagle fastened to his back, lying dead on a piece of ground which had been overflowed, but from which the water had then retreated. Captain Eurenus informed the same author that he was once an eye-witness of a similar circumstance. In this instance, when the Eagle first seized the Pike, he succeeded in lifting him for a short distance into the air; the weight of the fish, however, combined with its struggles, soon carried both down again into the water, under which they disappeared. Presently the Eagle was seen at the surface, uttering piercing cries, and apparently making great efforts to extricate its talons; all however were in vain, for after a long continued struggling he finally disappeared in the depths of the river.*

In the Swedish rivers the gums of the Pike are said to be periodically subject to a disorder by which they become of so spongy a texture, and so much swollen, that the teeth which are then partially concealed from view, seem scarcely able to perform their function. This change is said always to take place about the time of new moon. The Wermeland fishermen assert that while his gums are in this diseased state, the Pike is almost incapable of devouring his prey, and therefore, at the time mentioned, they hardly take the trouble of laying out their lines; and these simple people assign as the reason for this periodical impotency, that if his teeth were always in good order the Pike would soon eat up all other fishes.†

The size, strength, agility, and ferocity of the

* Field Sports of the North of Europe, i. 216.

† Field Sports, &c. i. 216.

Pike, combined with the goodness of his flesh, make his capture a favourite object of ambition with anglers. He is chiefly taken with trolling and spinning-tackle, which we have already briefly described. A contrivance called the *ligger*, peculiar to the great meres, or marshy lakes of Norfolk, is said to afford great diversion, and is thus described by Mr. Yarrell:—"The *ligger* or trimmer is a long cylindrical float, made of wood or cork, or rushes tied together at each end: to the middle of this float a string is fixed, in length from eight to fifteen feet; this string is wound round the float except two or three feet, when the trimmer is to be put into the water, and slightly fixed by a notch in the wood or cork, or by putting it between the ends of the rushes. The bait is fixed on the hook, and the hook fastened to the end of the pendent string, and the whole then dropped into the water. By this arrangement the bait floats at any required depth, which should have some reference to the temperature of the season; Pike swimming near the surface in fine warm weather, and deeper when it is colder, but generally keeping near their peculiar haunts. When the bait is seized by a Pike, the jerk looses the fastening, and the whole string unwinds; the wood, cork, or rushes, floating at the top, indicating what has occurred. Floats of wood or cork are generally painted, in order to render them more distinctly visible on the water to the fishers who pursue their amusement and the *liggers* in boats. Floats of rushes are preferred to others, as least calculated to excite suspicion in the fish."*

* Brit. Fishes, i. 439.

Small fishes, as trout, roach, salmon-fry, a young herring, or the hind part of an eel, are excellent bait for Pike; and for large ones a young one of their own species. But a bright-coloured small bird, a goldfinch or yellow-hammer, will frequently kill, when they will not look at trout or roach. The best time for catching them is the morning; if hazy, with little wind, so much the better.*

FAMILY III. SILURIDÆ.

(*Sheat-fishes*).

An extensive assemblage of uncouth and repulsive fishes is found composing this Family. They are entirely destitute of scales, instead of which some genera have an armature of large angular bony plates, others have only a naked skin, invested with a thick coat of slimy mucus. In general the head is very broad and flat, with a great cat-like face; the lips send forth beards (*cirri*) or fleshy tentacles, sometimes of great length. The mouth is small, sometimes furnished with close-set velvet-like teeth, but often quite toothless. In the great majority of the species the first ray of the dorsal, and of the pectorals, takes the form of a stout and strong articulated spine, the edges of which are often cut into sharp teeth pointing backward; these spines are formidable weapons of offence.

Four hundred species are reckoned as belonging to this Family, all of which are inhabitants of fresh waters. They abound in the great slow-

* O'Gorman, i. 318.

flowing rivers of both hemispheres, but chiefly in the hotter regions of the globe; a single species only is European, which is not a native of this country.

From what little is recorded of the manners of these fishes, they appear to lie habitually concealed in the mud of the bottom, with their long *cirri* floating free. The smaller fishes, attracted by these organs, approach to examine them, and are sucked in by the Sheat-fish, and for the most part swallowed whole. Many of the species are eaten with avidity notwithstanding their hideous aspect, the flesh being white, firm, and of good flavour.

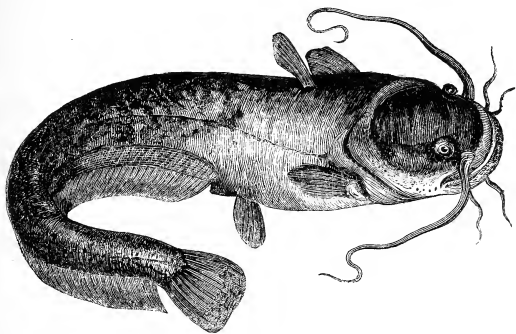
They may be considered as forming two Sub-families, the *Silurina*, with the skin naked and slimy; and the *Loricariana*, in which the head and body are mailed with large bony plates. The latter are chiefly South American fishes.

GENUS *SILURUS*. (LINN.)

The head in this genus is large, round, flat and naked, the mouth furnished with three pairs of long *cirri*; the body is lengthened; there is one small dorsal fin, unarmed with any spine; the pectorals and ventrals are small, but the anal is very long; the caudal is rounded.

The Sheat-fish or Sly Silure (*Silurus glanis*, LINN.), the only member of the Family which inhabits Europe, is perhaps the largest of freshwater fishes. In the large rivers of Austria and Southern Russia, where it attains its greatest development, it is said to be sometimes taken twelve and even fifteen feet in length, with a mouth suf-

ficiently capacious to gorge a child of six years old. It is found in the rivers of Africa and Asia, as well as those of Europe. The body is thick and long, but the abdomen is short; the tail, (by which is meant, not the *caudal fin*, but the part of the body behind the vent,) long and muscular; the head broad and depressed. The upper parts are of a deep green hue, becoming paler on the sides, and merging into yellow on the belly; the



SHEAT-FISH.

whole obscurely mottled. The fins are partly blue, and partly yellow.

The flesh of this species is greatly in demand on account of its good qualities; it is sent to the markets of Paris from the rivers of Germany. It is described as white, fat, and agreeable to the taste, but luscious, soft, and difficult of digestion to weak stomachs. The flesh is so greasy that it is said to be used as a substitute for lard.

FAMILY IV. SALMONIDÆ.

(Salmons.)

If the number of component members in any Family were the sole criterion of its importance, the present group would occupy a much less space in our pages than the preceding, containing, as it does, barely one-third of the number of its species. Yet when we think of the various Salmon and Trouts of Europe and America, and add to them the excellent and beautiful Char, the Smelt, small but delicious, the Grayling, Vendace, Gwyniad, Powan, and Pollan, the Capelin of Newfoundland, and multitudes of other foreign species unknown by English names, but valuable as the food of man, we shall be ready to acknowledge that the *Salmonidæ* constitute a very important and useful Family in the great Class of Fishes.

The typical Salmon are distinguished for the graceful, swelling symmetry of their form; thick and plump in the centre, and tapering to each extremity. Their body is covered with large and well-formed scales; all the rays of their fins are soft; behind the dorsal there is a small spurious fin, consisting of a doubling of the skin filled with fatty substance, but destitute of rays; this is usually known as the adipose (or fat) fin. In general the mouth is well furnished with teeth; their intestine has many cæcal appendages; and they all have an air-bladder.

The well-known fishes of this Family are powerful, bold, and voracious; in general, however, they do not prey upon other fishes, but

upon crustacea and water-insects. Most are inhabitants of fresh-waters, either permanently or periodically; a very few are marine. One hundred and thirty-two species are included in the Family by the Prince of Canino, which are widely scattered over the Old and New World.

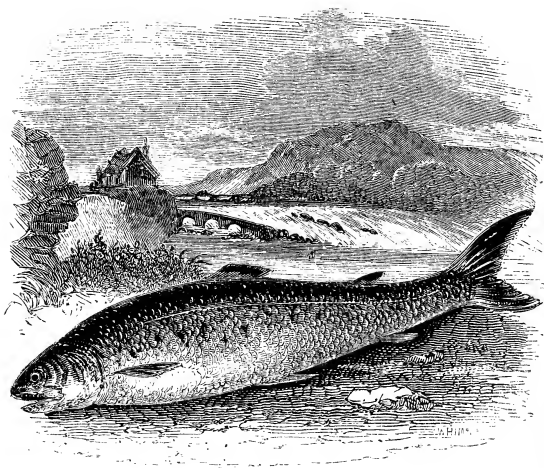
GENUS *SALMO*. (LINN.)

The true Salmons (including the Trouts) are the most completely toothed of all fishes, having a row of pointed teeth in the maxillaries, the intermaxillaries, the palatals and mandibularies, and two rows on the vomer, the tongue, and the pharynx,—so that there is scarcely a part of the interior of the mouth which is not bristling with this armature. The general form is spindle-shaped; the body is clothed with scales, of which the head is deprived; the mouth is cleft to the eyes or beyond them; the ventrals are placed under the dorsal, and the anal under the adipose: the belly is smooth; the air-bladder extends the whole length of the abdomen, and communicates with the gullet. The tip of the lower jaw is bent upwards in old males, and received into a notch above. Many species are marked with spots, and, in early youth, all are clouded with transverse dusky patches.

We have at least seven species of this genus in Great Britain, the common Salmon, five which bear the name of Trouts, and the Char. Of these the Salmon, the Salmon Trout, and the Bull Trout, are migratory, periodically ascending rivers to deposit their spawn, and then returning to the sea, exhausted with the effort. The others

are permanent residents in fresh waters. The flesh of all is unrivalled among fishes for excellence and flavour, and is in the best condition just before spawning; after that operation has been performed, it is poor, watery, and insipid. The migratory species display indomitable energy and perseverance in overcoming the various barriers that oppose their ascent, leaping over rocks and up cascades of astonishing height. It has been ascertained that individual fishes return year after year to their native stream, almost invariably.

The noblest species is our well-known Salmon,



SALMON.

(*Salmo salar*, LINN.), of which magnificent specimens crowd every fishmonger's table throughout the summer season. It attains a great size and

weight. Salmon of thirty and even forty pounds are by no means uncommon ; one has been killed by the angler's rod which weighed sixty-nine pounds and three quarters, and Mr. Yarrell has recorded the occurrence of one in the London market of the astonishing weight of eighty-three pounds. The head of the Salmon is small, the mouth not deeply cleft ; the body is thick and muscular, but with gracefully swelling outlines, tapering evenly away to the tail ; the caudal fin is slightly hollowed. The colours are blackish-grey on the upper parts, lead-grey on the sides, and silvery on the belly : a few dark spots are scattered over the back ; and the fins assume the same colours as the regions whence they originate.

The marketable demand for this excellent fish has made it the subject of important fisheries ; and as it can be taken with advantage only in rivers connected with territorial rights, and only at the particular season already mentioned, these fisheries are the subject of careful legislative prescriptions. To describe the various modes employed in the capture of the Salmon in British rivers alone would far exceed our space ; we can do little more than allude to them. Nets of many kinds, and traps of ingenious device, are sometimes stretched across the stream, to arrest the fish in its ascending course ; sometimes, as in the Forth, bag-nets are dropped from projecting platforms or stages ; or, as in the Solway, the fishes are received into funnel-shaped nets carried at the end of a long pole. In the Severn, the Welsh fishermen, seated in their funny little boats called *coracles*, drag a net between two, with which they take

this fine fish. Many other kinds of nets and seines are also used, some more general, others more local. In some rocky rivers Salmon are taken with the fish-spear, a mode of fishing that requires a quick eye, and a true hand. And numbers fall before the skill and science of the enthusiastic fly-fisher, who counts all other delights joyless to the excitement of his favourite sport.

In Mr. Jesse's very interesting "Scenes of Country Life," there is a letter from a nobleman, who had been on a fishing excursion into the highlands of Scotland, on the subject of fly-fishing for Salmon in the sea. From this communication we make the following extracts. The particular locality is not indicated.

"As far as I am aware there is only one spot in the neighbourhood where fish have been so taken. About four miles to the south of this place, a small river discharges itself into a creek or estuary, which formerly extended about six miles inland, but half of it has been reclaimed by carrying a mound from shore to shore. Within about a mile of the mouth of this creek, the main channel of the tide and the river approaches the south shore, and from the point which commands this channel, the fly is used with murderous effect at half ebb tide. Having a yacht and boats at my disposal, I anchored the latter two days since in the channel, and I never saw men so astonished as some of my Harwich sailors were with the spectacle which presented itself, as they had never seen a Salmon except on a fishmonger's stall. The air, rather than the water, was alive with Salmon and Sea-trout of all sizes, jumping

as high as if they had to scale a cataract, close to the boat. One which had jumped too far, was caught on the rocks by two of my boys whom I had left on the beach. . . For about an hour, I should say that the spot in question was the finest angling quarter I ever saw.”*

The author of “Wild Sports of the West” has described in his lively manner Salmon-fishing in Ireland. Fly-fishing commences in March, but many are not caught in this way until the succeeding month. In June, net-fishing begins. The weir is raised to stop the passage of the fish, the water being allowed to find vent only through a small aperture provided with a trap.

The fishing is carried on only in the estuary where the river meets the sea. The draughting is confined to the last quarter of the ebb, and the first of the flood; five or six boats with as many men in each are necessary. When the Salmon are seen, the nearest boat starts off, leaving a man on shore, with a rope attached to one extremity of the net, which is rapidly thrown over, as the boat makes an extensive circle round the place where the fish are believed to lie. This curve is gradually diminished; stones flung in on each side prevent the fish from escaping; at length the extremity of the net reaches the bank, the semicircle is complete, and the inclosed fish secured. They

* “It is supposed that the first taste of the admixture of fresh water gives the fish a ravenous appetite for the fly, which occasions their extraordinary jumping and easy capture. At the spot referred to, the admixture of fresh water would hardly be perceptible to our taste at half-tide, as the stream is inconsiderable, and the sea covers, at that time of tide, many hundred acres. The fish certainly forbear from their gambols at high and low water, and during the flow.” Page 255.

are carefully landed ; and five hundred Salmon have been taken at a single haul.

If the season be favourable from the 1st of July to the 12th of August, the daily average may be five hundred Salmon, besides an immense quantity of white Trout. But should the weather be rainy or tempestuous, the Salmon forsake the estuary and remain at sea till it clears ; so that the time limited by law sometimes elapses before a moiety of the fish can be secured.

Through the winter months the Salmon rises freely at the fly ; but the diminution of vigour and energy in the fish affords very inferior sport. Their beauty and their value too are gone. “ They are now reddish, dull, dark-spotted, perch-coloured fish, and seem a different species from the sparkling, silvery creatures we saw them when they first left the sea. As an esculent they are utterly worthless,—soft, flabby, and flavourless if brought to table :—instead of the delicate pink hue they exhibited when in condition, they present a sickly, unhealthy, white appearance, that betrays how complete the change is that they have recently undergone.

“ And yet at this period they suffer most from night-fishers. This species of poaching is as difficult to detect, as it is ruinous in its consequences. It is believed that the destruction of a few breeding fish may cost the proprietor a thousand.”

Night-fishing is prosecuted when the river is low and the night moonless. The poacher, armed with a gaff and carrying a torch, selects the gravelly shallows, where he may see the fish depositing its spawn ; he readily discovers them with the torch, and secures them with the gaff. Hundreds

of Salmon are thus destroyed, especially in the secluded mountain streams; detection is difficult, and conviction easily evaded. The depredations of poachers are largely connected with the demoralization of private distilling. The men are up all night attending to the still. The watch maintained against the revenue officers enables them to ascertain also when the rivers are unguarded. The firebrand is snatched from the still-fire, the easily-hidden gaff or spear drawn from its corner, and in a few minutes the poacher has exchanged one species of lawless industry for another equally illicit.

Mr. Lloyd describes a simple but effective mode of taking Salmon at Deje, in Sweden, where this fish is very abundant. By rocks or artificial embankments, a portion of the river is divided into several small channels. On each of these two sluices are constructed, one at each end, capable of being opened or closed at pleasure. The fish having once entered these traps, are prevented from returning, and the water being allowed to run off, they are taken out, even by hand, without the least difficulty. Five hundred, and even eight hundred Salmon are thus taken in a single day; though at the same locality, notwithstanding their abundance, they invariably refuse a bait.*

Many years ago, great quantities of Salmon were taken in the Thames; but that species of sport has been annihilated, in all probability by the influx of poisonous ingredients which flow in from gas-works and other numerous modern innovations, introduced during the last fifteen years.

Among the enemies of the Salmon is the Eagle,

* Field Sports, &c. i. 302.

probably the fishing Eagle or Osprey. A curious anecdote recorded by the author of "Wild Sports of the West," would intimate that victory does not always fall to the same side. "Some years since a herdsman, on a very sultry day in July, while looking for a missing sheep, observed an Eagle posted on a bank that overhung a pool. Presently the bird stooped and seized a Salmon, and a violent struggle ensued; when the herd reached the spot, he found the Eagle pulled under water by the strength of the fish, and the calmness of the day, joined to drenched plumage, rendered him unable to extricate himself. With a stone the peasant broke the Eagle's pinion, and actually secured the spoiler and his victim, for he found the Salmon dying in his grasp." A grey-haired peasant familiar with flood and field told the same writer that he had remarked the Eagles while engaged in fishing. They were wont to choose a small ford upon a rivulet, and, posted on either side, would wait patiently for the Salmon to pass over the shallows. Their watch was never fruitless;—many a Salmon he had seen, in its transit from the sea to the lake above the ford, suddenly transferred from its native element to the Eagle's wild aërie in the lofty cliff that beetles over the romantic waters of Glencullen.*

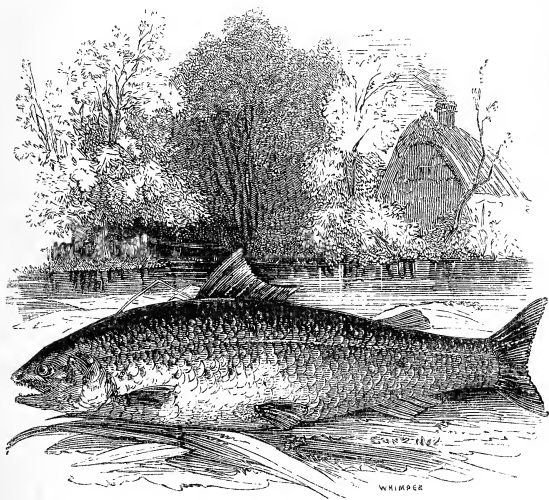
We shall close our notice of this interesting Family with a species scarcely less valued by anglers than the Salmon, the speckled Trout, (*Salmo fario*, LINN.), one of the most crafty, voracious, and swift of our fluviatile fishes.

According to Alexandre Dumas,† Trout are

* Wild Sports of the West, i. 195.

† New Sport. Mag. N. S. iii. 242.

caught in the streams of the Alps in a very original manner. The implements are a heavy knife or bill, and a lantern of curious construction. It consists of a hollow globe of horn, to which is affixed a steel tube three feet long, and an inch and a half in diameter. The junction of the tube and the globe being hermetically sealed,



TROUT.

the oiled wick within the latter, after having been lighted, receives air only from the top of the tube. The mountaineer, thus furnished, wades into the torrents that brawl through the valleys, *by night*, until the water reaches his middle. With his left hand he plunges the globe of the lantern towards the bottom to nearly the full length of

the tube. A dim circle of light is thus shed upon the bed of the stream, when the Trout, attracted by the light, crowd around the globe as moths around a candle. The fisherman then slowly raises the lamp, which the fish follow, towards the surface. He can now select the finest fish at his leisure, which he strikes with a well-directed blow on the head with his heavy knife. The fish instantly sinks to the bottom, but it is only for a moment, for it presently rises to the surface bloody and dead, and, floating there, is presently deposited in a bag hung round the operator's neck. The other fishes, alarmed for the moment, are soon attracted again, and become successively the prey of the fisherman, until his desires are satisfied.

FAMILY V. CLUPEADÆ.

(*Herrings.*)

In most of their characteristics the Herrings agree with the Salmon; and so close is the affinity between the two Families that the members of the Salmonidan genus *Coregonus*, the Pollans and Powans of our lakes, are called by the peasantry, both in this country and Ireland, the Freshwater Herrings. The same graceful form, curved in gently swelling outlines, and tapering to a point at each extremity, characterizes this Family, as the preceding; and like it the present is clothed in large, well-formed scales, very easily detached. Their chief distinction is the absence of the adipose fin in the Herrings, which have only a single dorsal of the ordinary structure, placed

near the middle of the back. The body is more compressed than in the Salmons, and in most of the genera the belly is very thin, forming a sharp edge, frequently cut into saw-like notches, by the projecting scales, the points of which are directed backwards.

The mouth is small and oblique, either furnished with minute teeth, or altogether destitute of these organs; the lips are very thin. The opening of the gills is more than usually wide; hence, by a law already alluded to, the Herrings can survive a removal from the water for only a very brief period. The common Herring and Pilchard are said to die in a few minutes after being caught. The stomach is a lengthened sac; the intestines are furnished with many *cæca*; and there is generally a long and pointed air-bladder.

The skeleton of fishes generally consists of a greater number of bones than that of other animals. The ribs are long and slender spines, but there are many other bones besides the ribs, supernumerary, or rather accessory, spines, which spring from the bases of the ribs, and other parts of the *vertebræ*. In the Herring family these spinous appendages are peculiarly developed; for they are long, and attached not only to the rib-bases, but to each of the spinous processes of the *vertebræ*, so that each of these joints carries three pairs of accessory spines, besides a series of slender diverging bones that run along the line of the abdomen.



VERTEBRA OF
HERRING.

The Family consists of one hundred and eighty known species, scattered over all parts of both oceans. Almost all of them are marine, and few of these ascend rivers. Generally they are of small size, comparatively few exceeding our own well-known Herring; yet to this rule the Shad of our rivers is an exception, which grows to three feet in length, and the genus *Megalops* of the tropical seas is found to attain twelve feet.

The food of such species as we are familiar with consists principally of minute crustaceous animals, and, it is probable, from the minuteness of the teeth in the Family, that the food is in general small.

GENUS *CLUPEA*. (LINN.)

Some of our best-known and most valuable fishes are contained in this genus, as the Pilchard, Herring, Sprat, and Whitebait, not to reckon the Shads and the Anchovy, which are now placed in separate genera. Its distinctive characters are that the mouth is small, obliquely vertical; the teeth very minute or absent, the jaws nearly equal, not notched; the belly line compressed to an edge, sharp, and generally serrated: the dorsal fin situated above the ventrals; the latter about equal to the pectorals, and both small; the caudal forked: the body is covered with large thin scales, removed with little force.

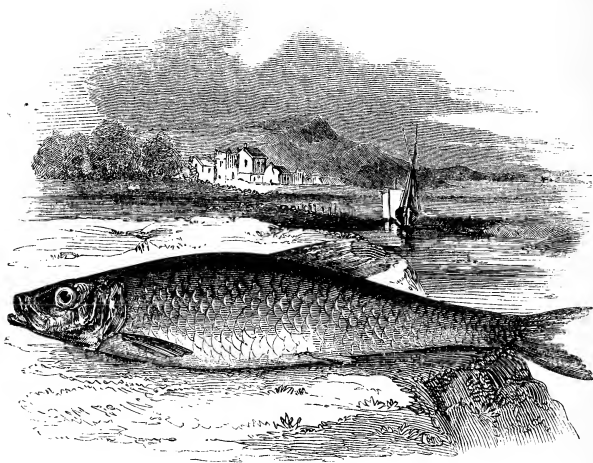
The Herrings are believed to be wholly carnivorous; and, as we have already observed, minute *Crustacea* form a large portion of their sustenance. Mr. Yarrell observes of the Pilchard, "I have found their stomachs crammed each with

thousands of a minute species of shrimp, not larger than a flea. . . . The abundance of this food must be enormous, if, as there can be no doubt was the case, all the schulls on the coast were as well fed as the individuals I examined." The Herring on the coast of Norway feeds upon a minute species of shrimp, the *Astacus harenngum* of Fabricius. The number of these minute creatures swimming in the sea during summer, is so incalculable, that a vessel dipped into the water will be found to have inclosed thousands. So great is the eagerness of the Herrings for these shrimps, that they follow them wherever they may chance to be driven by tides or currents; and by constantly feeding on them, the bellies of the fishes acquire a ruddy tinge, occasioned, according to Stroem, by a reddish humour contained in these minute marine insects, but more probably, as we think, explained by the effect of the gastric juice of the fish, *which turns all crustacea red, just as boiling does.*

Besides these, other creatures contribute to furnish food to the Herring tribe. Small medusæ, shelled mollusca, flies, the spawn and the young fry of other fishes, are all found to be agreeable to them. Mr. Yarrell was informed that the fishermen in the Bay of Biscay throw large quantities of the salted roe of fish about their nets, to attract Pilchards, and much of this substance is found in the stomachs of such as are caught. The Pilchard has been known to take a hook baited with a worm, and Herrings to bite at the artificial fly of an angler. They do not scruple to indulge even a cannibal appetite; for, according to Dr. Neill, five young Herrings have been found

in the stomach of a large old one; a sufficient proof of piscine voracity.

We shall illustrate the genus by this, its most valuable species, the common Herring (*Clupea harengus*, LINN.), so largely used, both in its fresh and salted condition, as the food of the poorer



HERRING.

classes of society. In form it is much compressed, its depth greatly exceeding its thickness. The lower jaw projects considerably beyond the upper; there are a few small teeth on both jaws and the tongue; the eye is large; the line of the belly is sharp, but not notched. The colours when fresh are a fine greenish blue on the upper parts, and on the sides and belly silvery white.

The immense hosts in which this fish assembles

at the season when it approaches the shallows to spawn, have given it its common name, Herring being derived from the German *heer*, an army. The end of October is the ordinary period of the commencement of the spawning season, but it seems subject to local variation. For two or three months before this, the fish is in the highest condition, and is the object of eager pursuit all around the coast. The principal places where the Herring fishery is carried on may be thus enumerated:—Yarmouth, Lowestoffe, Hastings, Folkestone, Cardigan Bay, and Swansea, in England and Wales; the coasts of Caithness, Sutherland, Aberdeen, Banff, Moray, and Ross, in Scotland; and Galway, the coast of Donegal, Mayo, the mouth of the Shannon, Bantry Bay, and the coast of Wicklow, in Ireland.

The number of barrels of Herrings cured in the British fisheries may be considered to average four hundred thousand per annum; this is, of course, exclusive of the vast quantities that are eaten in a fresh state. The fisheries of Northern Europe are also very extensive; in those of Sweden and Norway, it is said that near four hundred millions fish are taken yearly, and twenty millions have been the produce of a single port.

Yarmouth, whose smoked Herrings are well-known by the term “bloaters,” derives no small portion of its prosperity from this fishery. A hundred sail of vessels, averaging forty tons each, hail from this place, and about seventy hail from the neighbouring town of Lowestoft. This fleet is augmented by fifty or sixty vessels that arrive from the Yorkshire coast during the season. The capital engaged at Yarmouth is estimated at

250,000*l*. The fresh Herrings that are consumed in the metropolis are chiefly from the shores of Kent and Sussex.



YARMOUTH JETTY, IN THE HERRING FISHERY.

The Herring appears on our shores in the middle of summer, but seems to approach the coast of Scotland earlier; for in Sutherland the fishery commences in June, and in Cromarty even so early as May, while the Yarmouth season rarely begins till September. They are taken chiefly by means of drift-nets, described in our account of the Mackerel, and by far the majority are cured; in the first part of the season, however, they are

often so rich as to be unfit for salting, and these are sold for consumption while fresh. About the month of November, as has been already observed, the shoals spawn, and are then unfit for eating, and the fishery ceases. As is universally known, there are two modes of curing this fish, producing what are called white and red herrings. The former requiring only to be placed in barrels with salt, the process can be performed in the fishing-craft; consequently the vessels for this fishery are larger, being qualified to keep the sea.

The process as performed by the Dutch, who excel all other nations in this art, is described as follows. As soon as the fish is removed from the water, the throat is cut, and the offal is detached; it is then washed with sea-water, and laid in brine sufficiently saturated with salt to float the fish; about eighteen hours afterwards, the batch is taken out of the pickle, and placed, layer on layer, in barrels, with copious layers of salt; and here they remain as long as the boat continues at sea. On her arrival in port, the fish is re-barrelled with care, fresh salt being given them, and new brine poured over the whole.

Red herrings, however, require a much more elaborate process, which cannot be performed on board, and the procuring of them is essentially a shore fishery. The Yarmouth men confine themselves to this branch. They sprinkle the fish with salt, and lay them in a heap on a stone or brick floor, where they remain about six days; they are then washed, and spitted one by one on long wooden rods, which pass through the gills: great care is required that they may not touch each other as they hang; the rods are then suspended

on ledges, tier above tier, from the top of the house to within eight feet of the ground; a fire is then kindled, and fed with green wood, chiefly oak or beech, and maintained, with occasional intermissions, for about three weeks, or, if the fish are intended for exportation, a month; the fire is then extinguished, and the house allowed to cool, and in a few days the herrings are barrelled. "Bloaters" are prepared with much less salt, and therefore, though their flavour is milder and finer, they cannot be preserved good. Hence the supply of these is almost limited to the few weeks during which the fishery lasts.

FAMILY VI. GADIDÆ.

(*Cods.*)

We have here another Family of fishes eminent in their usefulness to man. Perhaps, indeed, if we consider the great number of edible species, the immense quantities in which some at least are procured, the excellence of their flesh both fresh and salt, and the facility with which they can be preserved for future consumption,—we may safely pronounce these the most valuable of all the finny tribes. There are about a hundred and ten species recognised, and of these fully one-third are European. Twenty-one species are enumerated as British, and of these the following eighteen contribute more or less extensively to supply the need of man:—the Cod, the Dorse, the Haddock, the Pout, the Poor, the Whiting, Couch's Whiting, the Coalfish, the Pollack, the Green Cod, the Hake, the Ling, the Burbot, three kinds of Rockling, the Torsk, and the Forked Beard:—a goodly list!

The Cods have the body but little compressed, generally rounded, sometimes nearly of equal thickness, at others thickest towards the head, and tapering towards the tail, rather long in proportion to the thickness. The head is naked, but the body is covered with small scales, which, however, are in general nearly concealed by a thick mucous skin, which also invests the fins, and gives them a peculiarly fleshy texture. The eyes are large; the mouth wide, furnished on the jaws and front of the vomer with small unequal teeth, set in rows like those of a card; the gill-openings are large, and there are seven gill rays.

The fins present some peculiarities; their thickened substance, sometimes almost concealing the rays, has been already alluded to; the ventrals are very small, pointed, and often produced into a fleshy filament; three of the five rays of which each of these fins is usually composed, are sometimes wanting, leaving only two thread-like rays destitute of membrane. On the other hand, the dorsal and anal are greatly developed in length; some, as the Cod and Haddock, appear to have three dorsals and two anals, but we incline to think these reducible to one lengthened fin of each kind, variously cleft or interrupted, according to the species. The pectorals and the caudal are of moderate size.

The muzzle and lips are often furnished with fleshy beards (*cirri*), varying in length, yet never long, and in number from one to five. The stomach is capacious and strong, as is also the air-bladder; the intestine is long, with many cæcal appendages.

The flesh of these fishes is generally white, firm,

and of good flavour, easily separated into flakes, wholesome, and easy of digestion. They inhabit for the most part the cold and temperate seas, a very few only being found in fresh waters. The northern Atlantic is the great home of the Family, few reaching to the tropical regions, and scarcely any wandering into the Pacific or Indian Oceans.

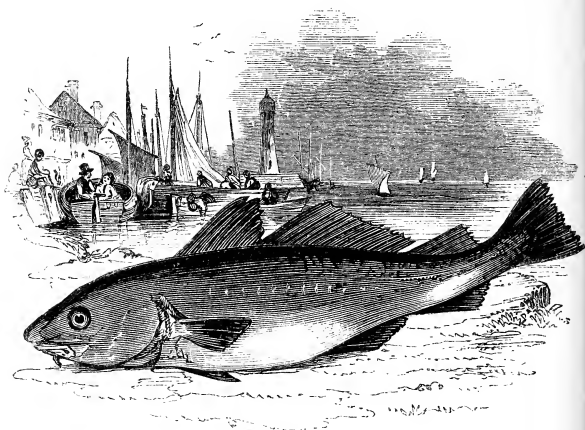
GENUS *GADUS*. (LINN.)

The Cods proper, (including the Haddock, but not the Whiting,) are distinguished by the following marks. The long dorsal is divided into three distinct portions, of which the first is triangular; the anal is divided into two; the ventrals are small, slender and pointed, placed beneath the pectorals; the caudal is straight-edged, or slightly hollowed. The chin is furnished with a small beard (*cirrus*) at the point. Five species of the genus as thus restricted are taken on our own shores, and none in greater plenty than the most valuable of them all, (perhaps of all fishes,) the Common Cod, (*Gadus morrhua*, LINN.) It attains three or four feet in length, and a depth of eight or nine inches; Mr. Yarrell mentions one which weighed 60lbs.; and Pennant speaks of another, caught at Scarborough, of 78lbs. The colour of the upper parts is a dull olive-brown, obscurely marked with yellow, fading to pure white beneath; the lateral line is white. There are two very distinct varieties, one of which has a sharp taper muzzle, the other a thick, rounded one; the former is darker in hue, and affects the southern coast.

The fishery for Cod on the banks and shores of Newfoundland and Labrador is the most important in the world, for the number of men and the amount of capital that it employs. It is estimated that twenty thousand British subjects are directly engaged in the fishery, and probably thrice as many are more or less directly supported by it. The annual produce of their efforts may be roundly stated at 600,000 hundred weights of dried fish, and 3000 tuns of cod-liver oil; the whole worth, at the place of shipment, 450,000*l.* sterling. It has been supposed that more than six thousand vessels are engaged in the Cod fishery on both sides of the Atlantic; and that thirty-six millions of these fishes are captured, salted and dried, to be then distributed over the various regions of the globe. "We have eaten them," says Mr. Swainson, "under the name of *Stock-fish*, in all parts of the Mediterranean, brought by our English vessels; and they are to be had in all parts of the Brazilian Empire,—being carried on the backs of mules from the sea-coast into those provinces of the interior, where fresh fish cannot easily be procured." We believe, however, that the term *Stock-fish* distinctively applies to the Cod dried whole, or gutted only, without salt, as the Norwegians treat their fish; the British split it, take out the backbone, salt it, and dry it flat. To Brazil and the West Indian Isles, Cod fish is sent in casks, pressed in by a screw; to the Mediterranean and home market it is shipped in bulk.

The Cod is a deep-water fish, rarely coming into the shallows; he is a voracious and almost promiscuous feeder. Unlike the Herring or Mackerel, it can scarcely be called gregarious;

great multitudes, it is true, congregate together, but they seem not to obey any common laws of motion, shifting their places in great shoals, but rather each obeying the impulse of his own independent will, attracted by the abundance of food, or other causes. From these circumstances, the



COD.

depth of its level, and its isolation,—the Cod is not much taken with nets, but principally with the hook and line.

There are two modes of capturing the Cod with the hook; the one is with what are called in Cornwall bulters, which are long lines, to which are attached, at regular distances, other lines six feet in length, each bearing a hook; the intervals are twice the length of the small lines, to prevent

their intertwining; these are shot across the course of the tide. The other mode is by hand-lines, of which each fisherman holds two, one in each hand, and each line bears two hooks at its extremity, which are kept apart by a stout wire going from one to the other. A heavy leaden weight is attached near the hooks, and thus the fisherman feels when his bait is off the ground. He continually jerks them up and down, and is thus aware of a fish the moment it is secured. Although this seems a somewhat tedious process of fishing compared with the immense draughts of the net, it is found in skilful hands to be productive: eight men on the Dogger-bank have taken eighty score of Cod in a day.

As in the Cod the peculiar texture and arrangement of the muscles, laid in broad thin parallel flakes, are more obvious than in most other fishes, we will take occasion here to quote a few observations of Professor Owen's on the nature of muscle in this Class of VERTEBRATA. "The muscular tissue (*myonine*) of fishes is usually colourless, often opaline, or yellowish; white when boiled: the muscles of the pectoral fins of the Sturgeon and Shark are, however, deeper coloured than the others; and most of the muscles of the Tunny are red, like those of the warm-blooded Classes. The want of colour relates to the comparatively small proportion of red blood circulated through the muscular system; and to the smaller proportion of red particles in the blood of fishes: the exceptions cited seem to depend on increased circulation, with great energy of action; and, in the Bonito and Tunny, with a greater quantity of blood, and a higher tempera-

ture than in other fishes. The deep orange colour of the flesh of the Salmon and Char depends on a peculiar oil diffused through the cellular sheaths of the fibres. The muscular *fasciculi* [bundles] of fishes are usually short and simple; and very rarely converge to be inserted by tendinous chords. The proportion of *myonine* [or muscular tissue] is greater in fishes than in other VERTEBRATA; the irritability of its fibres is considerable, and is long retained. Fishermen take advantage of this property, and induce rigid muscular contraction, long after the usual signs of life have disappeared, by transverse cuts and immersion of the muscles in cold water: this operation, by which the firmness and specific gravity of the muscular tissue are increased, is called ‘crimping.’”*

The Cod is observed to thrive in the confinement of ponds, which are either naturally or artificially hollowed in some parts of our rocky shores, and into which the sea has access at high tide. Other marine fishes, such as Haddock and Whiting, different sorts of Flat-fish and Skate, are also kept in these *vivaria*, and found to do well. They are fed with Sprats, the young and unsaleable of other fishes, shelled mollusca, and any animal offal, all of which is greedily devoured. On the Hebrides, and the adjacent coast of Scotland, there are several marine stews.

The following description of such a saltwater fish-pond, communicated to the New Sporting Magazine, will be read with interest, as everything that illustrates the habits and instincts of marine fishes is valuable. The pond is situated near the Mull of Galloway, on the west coast of

* Lect. on Comp. Anat. ii. 169.

Scotland. It was “originally a small basin in the rock, with which the sea communicated by means of a natural tunnel; but as the bottom was very little below the medium level of the sea, it was nearly dry at low water. It having occurred to Colonel M'Dowall that by increasing the size and depth of this basin he might, at all times and seasons of the year, have a constant supply of sea-fish, he quarried and blasted the rocks both at the sides and bottom, till he had formed a circular excavation of about fifty feet in diameter; and there is now, I believe, at low tide about eight feet of water left; so that the fish have an ample allowance of their native element at all times, and a fresh supply every flood-tide, which rises in the pond about six feet. There is a high wall built on the upper edge of the rock surrounding the pond, to prevent poaching in this unusual preserve; and a grating is fixed before the tunnel to prevent the escape of the fish, and below high-water mark the sea-weed clings to the rocks, giving them in that respect a perfectly natural appearance. A cottage, in which the female keeper and her son reside, adjoins the pond. . . .

“The door opens to a small landing-place at the top of a flight of steps which leads to the water's edge, where there is a platform of rock, which, at that time, was only about two inches above the level of the water; and below the ledge on which I was standing was another, about a foot under water—less or more. No sooner did the party make their appearance at the top of the stairs than there was a general commotion among the fish, and they rushed towards the platform, pushing and jostling each other in their

eagerness to get to the place where they are usually fed, just as barn-door fowls do at the sight of the person who feeds them. We came provided with a quantity of mussels, scalded, for the purpose of getting them more easily from the shell, a kind of food on which the Cod and other fish in the pond thrive amazingly; and I was informed that after having been thus *stall-fed*,—if I may so term it,—for a few weeks, they greatly exceed in flavour and juiciness their untamed brethren of the open sea. I held a mussel between my fingers, about two inches below the surface of the water, and immediately a Cod of about ten pounds weight took it, winning the prize by a head from three or four more of similar dimensions, all of which rushed towards my hand at the same time. It required all the nerve I could muster to prevent me from jerking back my hand at the moment the Cod, with widely extended jaws, took the bait. I made several attempts to get hold of one of them, but they all slipped from my grasp, except one small Cod of about four or five pounds weight, which I succeeded in making a prisoner. Having raised him out of the water and examined him at my leisure, I returned him to his native element, at which he seemed as much pleased as I should have been in regaining *terra-firma* after an involuntary immersion. There was one large Cod of about ten pounds weight that I made several attempts to get hold of without success, as from his great size and strength he always escaped, and as he could not throw *dust* in my eyes, he revenged himself by darting off with a *whisk* of his tail that sent the *water* flying over me. After taking a short run, he always returned

to the ledge of rock on which I stood, nothing daunted by my repeated attempts to seize him. The keeper took one of the largest, about the same weight, in her lap, and stroked and patted it, saying, 'Poor fellow! poor fellow!' just as if it had been a child, and she opened its mouth, and put in a mussel, which he swallowed with apparent *gusto*—at least so I interpreted a wriggle of his tail at that moment—and she then put him back again. I observed several gradations of tameness in the fish; some were *quite* tame, and came close up to the ledge on which I was kneeling; another class kept parading from right to left about two or three yards from me, but they readily partook of some food that was thrown to them: a third kept aloof altogether, and would have nothing at all to do with me; and others, which I did not see, kept themselves secluded from sight in the nooks and corners at the bottom of the pond, and were, I suppose, the 'Johnny Newcomes,' or 'Griffins,' of the place.

"It is a curious fact that fish when they remain long in this pond always become blind; and I was informed that this is owing to there not being sufficient shelter for them from the heat and glare of the sun, owing to the shallowness of the water compared to the depth of their usual haunts. Several which I saw in this state are fed entirely by hand, as they are unable to compete in obtaining food with those whose sight is unimpaired. Surely some remedy might be found for this. One large and blind fellow called 'Jack' is a great pet, and upon the keeper calling his name, he appeared to hear and understand her, for he came forward slowly, and she held a mussel to his

mouth, which he swallowed. The fish appear occasionally to disagree among themselves, as I saw one Cod with one eye apparently bitten out, and hanging over its cheek.

“At the time of my visit there were only three kinds of fish in the pond, viz., Cod, Flounder, and a small fish of about three pounds weight (the name of which has escaped my memory); but they frequently preserve Salmon in the same way, besides other kinds. The manner in which they keep up the stock is this. The son of the female who has the charge of the ‘preserve’ goes out to sea in a boat with a tub or well; and when he catches any fish that he thinks will do, he preserves them in the well, from which he transfers them to the pond, where, in due time, from a month to six weeks, they become tame. A curious scene occurred on one occasion when he put a Mackerel into the pond: there was a general chase after the unfortunate fish, which only saved itself from being devoured by the larger and more ferocious denizens of the place, by running itself on a ledge of rock.”*

The following remarkable anecdote, communicated to Mr. Jesse by a respectable gentleman in Scotland, would appear to prove that even fishes are not destitute of that measure of reasoning power which enables them to combine cause with effect. “I was ordered to take the cutter I commanded to Port Nessock, near Port Patrick. On landing, I was informed of Colonel M'Dowall's sea fish-pond, and went to look at it. On arriving, I fed the large Cod out of my hand from some mussels which I had in a basin. I purposely,

* New Sport. Mag. vol. xiii. 12.

however, retained one mussel in the basin, and offered it to the Cod, in order to see how, with its broad mouth and short tongue, it would reach it. The Cod blew into the basin (a small slop-basin), and the re-action forced the mussel out of it, and the Cod seized it immediately. This fish allowed me to pat it on the back, and rested its head upon the stone on which I was standing, just like a dog. The other fish came to me and fed on the mussels I threw to them, but would not let me handle them, though I patted some of them."*

The analogous case of the Elephant that blew the sixpence out of the angle of the shelf on which it was placed, when it was too close to the wall to admit the finger of his trunk, will doubtless occur to many of our readers. We are, however, much more surprised to hear of such an effort of reasoning power in a Cod-fish than in an Elephant.

FAMILY VII. PLEURONECTIDÆ.

(*Flat-fishes.*)

The Turbot, the Sole, and the Flounder, are so familiar to every one, as the commonest fishes at our tables, that probably few think of the extraordinary anomaly presented by their structure, or remember that they are perfectly unique among vertebrate animals. We see that one side is dark and positively coloured, the other is white or slightly tinged with a fleshy hue, and we are apt to suppose that they offer no greater pecu-

* Scenes of Country Life, 62.

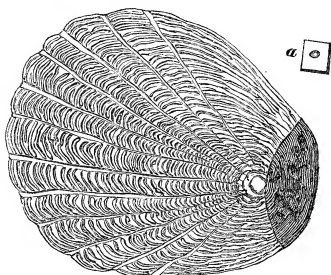
liarity than that of being greatly depressed or flattened horizontally, like the Skates, which at first sight they much resemble: but, in fact, the coloured surface is not the back, nor the white surface the belly, in the Flat-fish, but these are truly *the two sides*, right and left, so that instead of being depressed, it is compressed, or flattened vertically, like the Chætodons. The latter, however, like other fishes, swim with the back uppermost, notwithstanding their thinness; but the Turbot or Sole, swims or grovels along the bottom, *upon its side*, the coloured side, right or left, being uppermost. The term *Pleuronectes*, compounded of two Greek words, signifying *side-swimmer*, expresses this peculiarity.

But this is not all. If the eyes had been placed like those of the Chætodon, for example, one on each side, that which belonged to the white or inferior side, would be rendered useless, since it would be almost perpetually buried in the mud of the bottom. Hence, by an unprecedented exception to the symmetry which marks the organs of sense in all other vertebrate animals, both of the eyes are placed on the same side of the head, one above the other. They are, however, frequently not in the same line, and one is often smaller and less developed than the other.

In addition to the above peculiarities, we may mention that the spine makes a sudden twist near the head to one side; that the bones of the head are not symmetrical; that the two sides of the mouth are unequal; that the pectoral and ventral fins of the under side are generally smaller than those of the upper; and that the dorsal and anal generally correspond to each other, the one fringing

the whole length of the dorsal, the other that of the ventral edge of the body.

The scales are generally small; those of the Flounder, one of which is here represented, have the margin entire all round, or only slightly waved at the front edge, with no spines behind. The form is more or less round, and the appearance generally much resembles that of a scallop shell (*Pecten*). The concentric lines are coarse, and are divided by bands radiating from a point

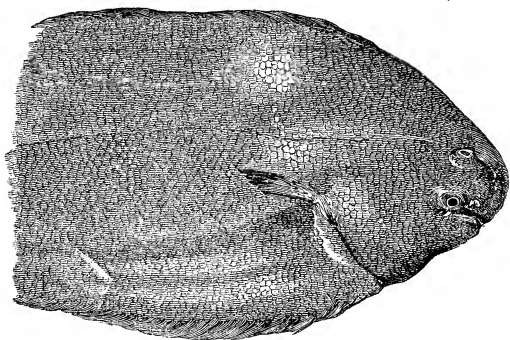


SCALE OF FLOUNDER, magnified.
(a, the natural size.)

behind the centre, which exhibit only transparent crystalline substance, without any trace of lines, even under a high magnifying power.

On the adaptation of the singular structure of the *Pleuronectidæ* to their habits, Mr. Yarrell has some interesting observations, which we shall take the liberty to quote. "The Flat-fishes and the various species of Skate are, by this depressed form of body, admirably adapted to inhabit the lowest position, and where they occupy the least space, among their kindred fishes. Preferring

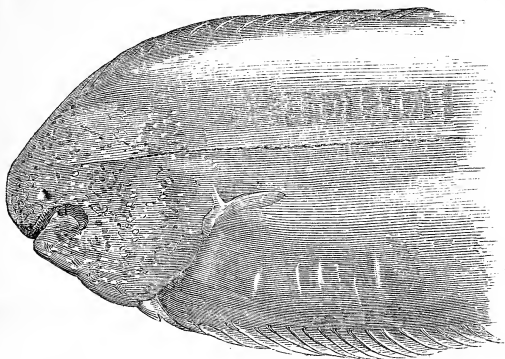
sandy or muddy shores, and unprovided with swimming-bladders, their place is close to the ground, where, hiding their bodies horizontally in the loose soil at the bottom, with the head only slightly elevated, an eye on the under side of the head would be useless; but both eyes placed on the upper surface afford them an extensive range of view in those various directions in which they may either endeavour to find suitable food, or avoid dangerous enemies. Light, one great cause of colour, strikes on the upper surface only; the under surface, like that of



UPPER SIDE OF THE SOLE.

most other fishes, remains perfectly colourless. Having little or no means of defence, had their colour been placed only above the lateral line on each side, in whatever position they moved, their piebald appearance would have rendered them conspicuous objects to all their enemies. When near the ground, they swim slowly, maintaining

their horizontal position; and the smaller pectoral and ventral fins on the under side are advantageous where there is so much less room for



UNDER SIDE OF THE SOLE.

their action, than with the larger fins that are above. When suddenly disturbed, they sometimes make a rapid shoot, changing their position from horizontal to vertical; if the observer happens to be opposite the white side, they may be seen to pass with the rapidity and flash of a meteor; but they soon sink down, resuming their previous motionless, horizontal position, and are then distinguished with difficulty, owing to their great similarity in colour to the surface on which they rest.”*

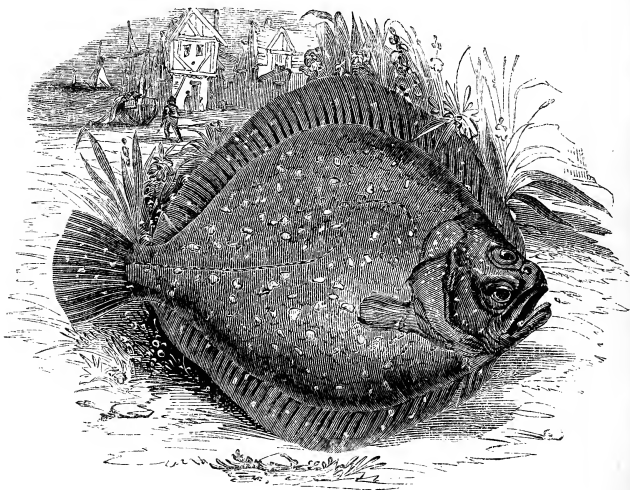
Very little variation from the common form is found in this Family, which yet is rather numerous in species: one hundred and fifty are enumerated by the Prince of Canino, which are all

* Brit. Fishes, ii. 298.

marine, and are scattered over the Mediterranean, Atlantic, and Pacific. Their flesh is generally in esteem.

GENUS *RHOMBUS*. (CUVIER.)

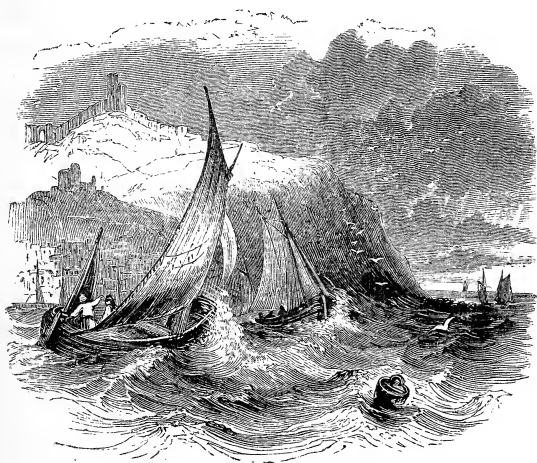
The Turbots and Topknots are generically distinguished by the following characters. The jaws and throat (*pharynx*) are furnished with small, pointed, close-set teeth: the dorsal fin com-



TURBOT.

mences between the upper eye and the muzzle, and extends almost to the caudal, as does the anal on the opposite side: the eyes and colour are generally on the left side.

One of the most esteemed of British fishes is found in this genus, the Turbot (*Rhombus maximus*, LINN.); which is also one of the largest species of the Family. In form it is nearly square, the head and tail being at opposite angles. Two feet in diagonal diameter may be considered as a fair size; but individuals are sometimes



TURBOT BOAT OFF SCARBOROUGH.

found much larger. Rondelet states that he has seen one five cubits (or seven and a half feet) in length, four in breadth, and a foot in thickness. Mr. Couch notices one which weighed seventy pounds, taken in 1730, near Plymouth; and another is said to have been taken in 1832, near Whitby, weighing a hundred and ninety pounds. The left or upper side is of a dark brown hue,

with lighter fins; the surface is studded with small bony knobs, which are not found beneath.

The Turbot is found in considerable abundance all round the British coasts, and is the subject of a valuable fishery. The trawl-net is used for its capture, and also the deep-sea line, baited with some small fishes, either such as have great tenacity of life, to keep long in motion, or else such as are attractive from their brilliant silvery hue. The Dutch pursue the Turbot with more energy and success than our own fishermen, and a large portion of the supply for the London market is taken by those enterprising foreigners. They are said to draw no less a sum than 80,000*l.* a year from the Billingsgate market for this fish alone, while 12,000*l.* to 15,000*l.* are paid to the Danes for lobsters to be used as sauce to the Turbots. Our own fishery is chiefly pursued on the coast of Yorkshire, Durham, and Northumberland. It continues from the beginning of April to the middle of August.

FAMILY VIII. CYCLOPTERIDÆ.

(*Suckers.*)

A small Family of Fishes of little value or importance either in a commercial or scientific point of view, is distinguished under the above name by a curious sort of sucking disk, by means of which they are enabled to adhere to the rocks of the bottom, or any other substance. This disk is situated on the inferior surface of the body, and is formed by the union of the large pectorals, which are connected by a membrane.

In some of the genera the ventrals unite with the pectorals to make the disk; in others, they form a second circular disk in immediate contact with the other. The head is usually large and more or less flattened, while the body is commonly compressed laterally. The body is smooth, destitute of scales, sometimes unctuous or slimy, and generally repulsive in appearance, though often coloured with bright hues. The snout is lengthened but obtuse. The skeleton is so soft that some members of the Family are said to dissolve after death into a mucilaginous jelly, in which hardly any trace of bone remains.

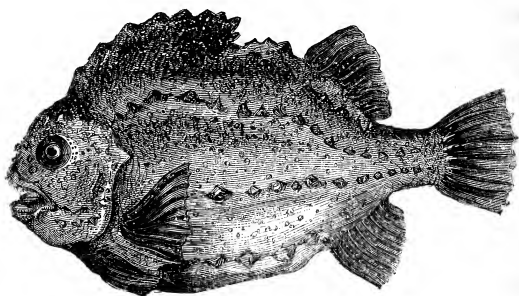
There are about forty species now known, half of which are European, and one eighth British. The others inhabit the coasts of the Atlantic and Pacific.

GENUS *CYCLOPTERUS*. (LINN.)

In this genus the head and body are deep, thick, and short; the back is surmounted by an elevated ridge, bearing no small resemblance to an anterior dorsal fin; this ridge is supported by several simple rays, but is covered with a hard skin. The pectorals unite with the ventrals to form a single disk beneath the throat. The whole body is covered with bony knobs or tubercles, some of which are larger, and arranged in longitudinal rows.

The Lump Sucker, or Cock-paddle (*Cyclopterus lumpus*, LINN.), is taken all round our shores, but is more abundant as we approach the north. It attains a foot and a half in length, and is of the most brilliant colours. The body and head have

their superior parts variegated with shades of dark blue, bright blue, and purple; while the inferior parts, and all the fins, are of the richest orange colour. This perfection of colour, however, is only seen at the breeding season in spring; after



LUMP SUCKER.

this is over, the red tints disappear, the blue and purple become dull, and the brilliant effect is lost. Its excellence as food is in proportion to the gaiety of its dress.

Some interesting points in the domestic economy of this fish, its parental affection and courage, have been noticed in a previous page of this work.*

* See p. 23.

FAMILY IX. ECHENEIDIDÆ.

(Remoras.)

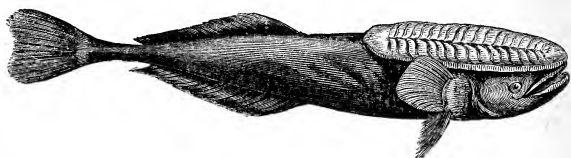
The species, about twenty in number, which compose this Family, are all included in a single genus. They are at once distinguished by a lengthened oval disk running along the top of the head, divided into two longitudinal portions by a central ridge. Across each division run many transverse plates of cartilage, having a finely toothed edge directed backwards. They either lie flat, or can be made by muscular effort to stand partially erect. The body is lengthened, and covered with small scales, ordinarily concealed by a dense coat of mucus, only perceptible to the touch if the hand be passed along the surface from the tail forwards. The mouth is wide, and opens vertically upwards; the jaws, tongue, and vomer are furnished with small teeth. There is a single dorsal placed far back, and opposite to the anal.

The species are chiefly natives of the warmer seas; two are recognised as inhabiting the Mediterranean, and a single example of one of these has been taken on the British coast.

GENUS *ECHENEIS*. (LINN.)

As the technical characters of this, the only genus of the Family, have been enumerated above, they need not be repeated. We shall, therefore, content ourselves with a brief notice of the common Remora (*Echeneis remora*, LINN.) of the

Mediterranean; a specimen of which was taken by Dr. Turton from the back of a Cod at Swansea, in the year 1806. The coronal disk in this



REMORA.

species contains about eighteen pairs of plates; the fins are leathery, the caudal forked. The body is of a dusky hue, darker on the upper parts and paler below.

The natives of Hispaniola and Jamaica are described by the early Spanish writers as in the habit of using a species of this genus in fishing. The fisherman, carrying the Remora out in his canoe, attached around its tail a slender line of great length, and threw it overboard. The instinct of the Remora impelled it to fasten on any fish that chanced to swim by, when the owner hauling upon the line, gradually drew in both fishes, the hold of the sucker pertinaciously retaining the prey in spite of all its efforts to escape. From some observations of our own on the habits of a large West Indian species, we are inclined to believe this account, though we do not know that the device is at present employed. At Mozambique, an oriental species is said to be used in exactly the same manner for the capture of Turtle sleeping at the surface.

FAMILY X. OPHIDIADÆ.

(Blade-eels.)

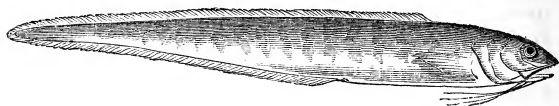
A small number of Fishes, by most naturalists arranged with the Eels, the Prince of Canino elevates to the rank of a Family under the above name. They resemble the Eels in having the intestine carried far backwards, the anal orifice being removed to a considerable distance from the head; and in the dorsal and anal fins meeting at the point of the tail; the skin also is covered with minute scales almost concealed by being imbedded in its substance. The gill-openings, however, are large, and the gill-covers have free motion: the rays of the dorsal are jointed, but not branched; the body is long, and generally much compressed, so that these fishes have been compared to sword-blades. Some of the species are furnished with *cirri* or beards, of which others are destitute. Some are opaque and of dark colours; others are delicately pellucid, tinged with carnation or rose-colour, with black fins.

About five and twenty species are known, all of which are marine, inhabiting the Mediterranean and the Atlantic. Some three or four are marked as British.

GENUS *OPHIDIUM*. (LINN.)

The body in this genus is eel-shaped, compressed and opaque; the head is smooth; the eyes very large; the throat furnished with *cirri*; there are teeth in both jaws, as well as in the palate and *pharynx*.

The Bearded Ophidium (*Ophidium barbatum*, LINN.) is a native of the Mediterranean, but is said to have occurred on the coast of Britain. It



OPHIDIUM.

grows to eight or nine inches in length, and is of a silvery flesh-colour, slightly mottled with brown. It feeds on small fishes and crustacea; its flesh, though eaten, is in little esteem, being coarse and ill-flavoured.

FAMILY XI. MURÆNADÆ.

(*Eels.*)

Like the preceding Family the Eels have a serpent-like body, lengthened, and more or less cylindrical. They are covered with a thick, soft, slimy skin, in which their scales are deeply imbedded, and scarcely to be detected. The operculum and gills are concealed; the former being covered with the common skin, while the gill-aperture is very small, and placed far back. Hence, on the principle already explained, these fishes are capable of surviving a protracted deprivation of their ordinary element. The ventral fins are always wanting; as are sometimes the pectorals; the dorsal and anal are lengthened, and frequently united to the caudal, or united to the exclusion of the caudal. All the fins are

soft and leathery. The intestines are not furnished with cæca; but the air-bladder is generally well-developed.

About one hundred and fifty species are recognised as constituting this Family, some of which are exclusively marine, others exclusively fluvial; while others, as our own common Eels, are found in both salt and fresh waters. They are widely scattered over most parts of the globe.

One of the most curious forms of the Family is that of the *Gymnotus* or Electric Eel, containing a few species peculiar to the rivers of tropical South America. The species best known, which has been exhibited alive in England, attains a length of five or six feet, with a diameter of eight inches. It has the power of communicating electric shocks of such violence, that the largest animals are stunned, and even destroyed by them. The organ which possesses this truly formidable power, consists of two large bundles of tendinous fibres on each side, occupying the hinder regions of the animal's body; these are crossed at right angles by other plates of the same kind, and thus a wide and deep network of cells is formed, each filled with a tremulous jelly; the whole organ may be likened to a powerful voltaic battery. Contact is not necessary for the exercise of its powers; it is said that shocks sufficient to kill other fishes are communicated through water to a distance of five or six yards.

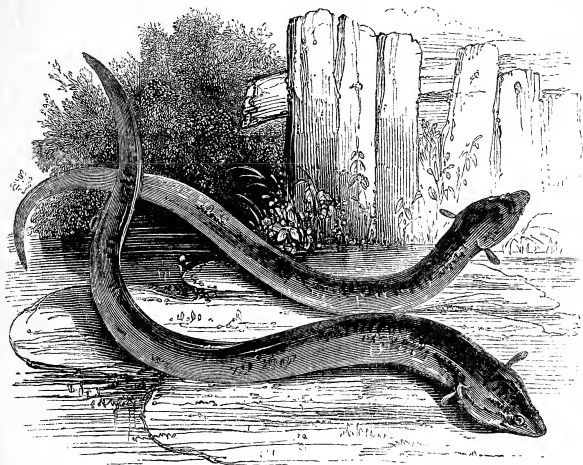
GENUS *ANGUILLA*. (Cuv.)

The pectoral fins are well developed, though small, in this genus; the dorsal and anal are con-

tinuous all round the tail. The dorsal commences at a considerable distance behind the insertion of the pectorals. The gill-opening is a small slit on each side, situated just at the base of the pectoral. The upper jaw is shorter than the lower; the mouth is furnished with small teeth in each jaw, and a few at the front part of the vomer. The whole body is covered with a thick, smooth skin, well supplied with a slimy mucous secretion. The intestine is long but straight; the air-bladder is also long, and furnished near its middle with a peculiar gland. A curious pulsating sac has been recently discovered in the tail of the Eels, with regular beats, quite independent of the action of the heart; the object of this organ is the circulation of *lymph*, a thin colourless fluid, having much of the nature of blood, deprived of its colouring disks. Similar organs have been observed to exist in some Reptiles, particularly *Amphibia*.

The Eels are properly fresh-water fishes, which migrate to the sea after they have deposited their spawn in the rivers. We have three or four species, differing a little in the form of the head, but sufficiently alike both in appearance and habits to allow of one being taken as a fair sample of the rest. The most common is the Sharp-nosed Eel (*Anguilla acutirostris*, YARR.), which is abundant in most of our rivers, lakes, and marshes, as in those of continental Europe. In the waters of high mountains, however, and in countries subject to severe winter's cold, the Eel is not found, as it cannot endure a very low temperature. "During intense frosts, accompanied by a piercing east wind, thousands of

Eels, though buried in the mud, have been known to perish ; and, crawling from their lurking holes



SHARP-NOSED EEL.

in the agonies of death, have been washed down the stream to the tideway, and thrown upon the beach."

Much obscurity has rested upon the breeding of the Eel ; but it is now ascertained that they are oviparous like most other fishes, and that the spawn is deposited in spring, either in lakes and ponds, and the higher parts of rivers, or at the mouths of the latter, where the salt water mingles with the fresh. In the earlier summer months, thousands of little Eels are seen making their way up the streams, for the most part about three inches long. In the autumn there is

another migration of adult Eels to the sea, for the purpose of spawning. Great numbers, however, remain in the fresh waters through the winter, hiding themselves in the mud, where they become torpid till the return of mild weather.

Eels are taken in various modes. One called *totting* is performed by cutting a hole in the weeds, on a gravelly bottom, and placing a boat there. The fisherman is provided with a short stick, with a cord at the end, to which is attached a bunch of worms strung on worsted with a leaden plummet in the midst of them. To this curious bait, as soon as it reaches the bottom, the Eels crowd, and suck at the worms, when the *tot* is quickly drawn up into the boat. The Eels drop off into the boat, the tot is plunged again, and soon again comes up loaded with fish. It is a nocturnal amusement, but when the weather is favourable produces good sport.

In mill-waters many Eels are taken in the following way. A frame-work is fitted to one of the smaller gates, to which is affixed a net of very strong cord, sixty feet in length, becoming narrower towards the extremity, where a hoop-net is tied, to receive the Eels carried down by the stream. When used, the other gates are closed, the one in question only being left open. The net must be watched, and the weeds or drift wood that accumulates taken out; the Eels also must be removed at intervals, for otherwise they would be crushed to death by the force with which the rushing current packs them together. Thirty or forty stone of Eels are thus sometimes taken in one night; generally very fine

ones, averaging a pound weight each, and some even reaching four or five pounds.

Eels are caught also by osier baskets called *leaps* or *grigs*, sunk in different parts of the stream. A new basket is never entered until it has been some weeks in the water, the smell of the wicker being, as is supposed, disagreeable to the fish. They bite freely at the hook; the best bait being small gudgeons, minnows, or sticklebacks, as being more easily gorged than larger fish, which the Eels suck off the hooks. The efficiency of the bait is increased by its being first dried by exposure to the air, as it is then less liable to be sucked off in fragments by the small fry. Larger Eels are taken with single hooks, than with forty or fifty hooks on a long line across the stream, because the best Eels swim near the bank.

In the Thames, during the spring months, Eels are taken abundantly by laying night-lines, but the mass of weeds that springs up from the bottom as the summer advances, necessitates the discontinuance of that mode of fishing; and the delicious *Eel-pies*, so celebrated in the neighbourhood of Hampton and Twickenham, are chiefly supplied from the canals of Holland, whence they are imported much cheaper than they can be caught even in the vicinity of the "Eel-pie houses."

During the season of its activity the Eel is a voracious feeder. Aquatic insects and their larvæ, *crustacea* and *mollusca*, the spawn of fishes, and even fishes themselves, are devoured by them. Mr. Yarrell says that the Eel will attack large Carp, seizing them by the fins, though unable

to do them serious injury. Mr. Jesse mentions a habit which implies the union of much sagacity with voracity, and reminds us of the device of the gregarious wolves in North America, which surround a herd of bisons or deer, and gradually force them to a precipice, that, being compelled to leap down, they may be killed; after which the crafty pursuers descend and feed upon the bodies at their leisure. "A large quantity of Eels have been observed, in one of the Cumberland lakes, to form a circle round a shoal of small fish in shallow water; and after driving them to the shore, they readily caught and fed upon them. I have observed the same thing take place in the canal in Hampton Court Park."*

The excellence of these fishes is well known. Immense numbers are consumed in London and other large cities; principally supplied by the Dutch. One or more Dutch boats constantly lie off Billingsgate; others run back to Holland for fresh supplies, each bringing a cargo of 15,000 to 20,000 pounds weight of live Eels.

FAMILY XII. SYNGNATHIDÆ.

(*Pipe-fishes.*)

Peculiarities of structure and form, of economy and manners, render this Family, though small both in extent of species and individual dimensions, one of very great interest. Their bodies are long and slender, with the muzzle produced into a tubular snout, just as in the *Fistulariadae* among the ACANTHOPTERYGII, whence, like

* Jesse's Scenes of Country Life, 351.

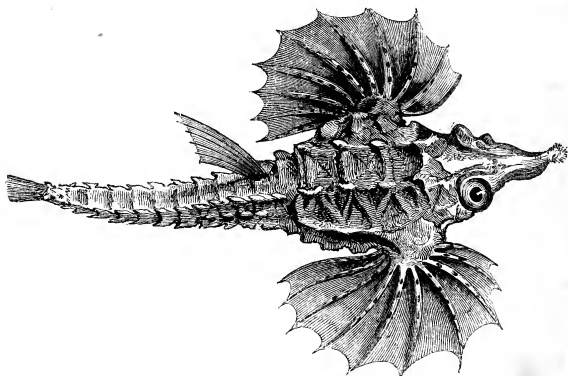
them, these have obtained the name of Pipe-fishes. The body is covered with a cuirass of bony plates, generally of angular form, and so arranged that the body itself is many-sided. The gill-covers are large, but soldered down for the greatest part of their edge, leaving only a small orifice for the discharge of the water which has been respired. The gill-rays are formed in the usual manner, but the gills themselves, instead of taking the form of fringes, set in parallel series like comb-teeth, are disposed in small tufts set on the arches in pairs; a structure of which there is no other example in the whole Class.

The reproduction of the species in this Family is attended with some circumstances truly anomalous. The male acts as a sort of nurse for the rearing of the infant progeny, thus relieving his mate of the parental cares which usually devolve upon the female. For this end he has on the abdomen, extending for about two-thirds of its length, two soft flaps which fold together, and thus form a false belly or pouch. The spawn is deposited by the mother in this receptacle of her partner, where it becomes matured, and in which the young escape from the capsules. But even when active, and able to shift for themselves, the young resort, in cases of alarm, to the paternal pouch for shelter. Mr. Yarrell was assured by fishermen that if the young of the Great Pipe-fish (*Syngnathus acus*, LINN.) were shaken out of the pouch into the water over the side of the boat, they did not swim away, but when the parent fish was held in the water in a favourable position, the young would again enter the receptacle. The analogy

presented by these curious fishes to the Marsupial Mammalia will doubtless occur to our readers.

One hundred species are now known to belong to this Family, all of which are marine: they are scattered over the seas and oceans of both hemispheres. Seven species are recognised as British. Two Sub-families are indicated, which are thus distinguished:

1. *Pegasina*. In these the body is depressed, and broad; the snout lengthened and tubular, but the mouth is placed beneath, and is moveable.



PEGASUS.

The pectorals are very large, and the ventrals are composed each of a single slender ray. The species inhabit the tropical seas of the eastern hemisphere.

2. *Syngnathina*. The head and body are slender and compressed; the mouth opens upward at the extremity of the snout; the ventrals are

wanting; and the pectorals, when present, are very minute.

GENUS *Hippocampus*. (LINN.)

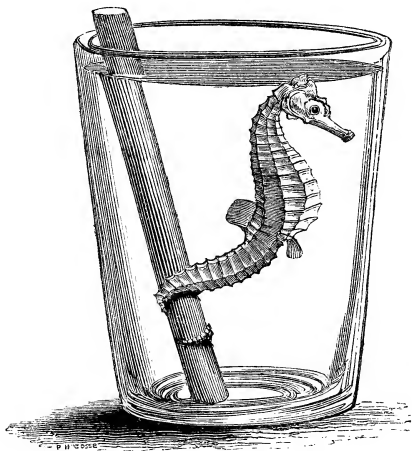
The body in this singular genus is compressed or flattened laterally, and is much deeper than the tail; the muzzle is narrow and tubular, with the mouth opening at the point nearly horizontally. The profile is angular; there is one small dorsal, no caudal, and no ventrals; small pectorals, and a minute anal in the male only. The margins of the angular plates in which the body is encased are raised in ridges, and the angles form spines. The slender tail is prehensile, and enables the little fish to hold on, or to climb by the stalks of marine plants. Specimens are often dried as curiosities, and the head and foreparts assuming somewhat of the figure of those of a miniature horse, they are commonly called Sea-horses.

A little species, the Short-nosed Sea-horse (*Hippocampus brevirostris*, Cuv.), is found, but in no abundance, on the shores of the British Islands. It is about five inches in length, of a pale ashy hue, with a changeable iridescence of flitting hues playing over its body, mingled with variable shades of blue: the eyes are pale yellow.

The food of this, as of kindred species, is believed to consist of minute animals and spawn, which are supposed to be drawn up the tubular mouth, by the dilatation of the throat, on the same principle that water rushes up a syringe, when a vacuum is formed by a retraction of the

piston. The Sea-horse is sometimes found coiled up in oyster-shells.

The habits of this species in confinement have been recorded by Mr. Lukis in an interesting manner, as observed in two individuals, kept by



SEA-HORSE.

that gentleman in a glass vessel of sea-water at Guernsey. They were both females, and at the time of the record had been living in health twelve days in captivity, displaying actions and habits equally novel and amusing. "An appearance of search for a resting place induced me," observes this gentleman, "to consult their wishes, by placing seaweed and straws in the vessel: the desired effect was obtained, and has afforded me much to reflect upon in their habits. They now

exhibit many of their peculiarities, and few subjects of the deep have displayed, in *prison*, more sport or more intelligence.

“When swimming about, they maintain a vertical position; but the tail is ready to grasp whatever meets it in the water, quickly entwines in any direction round the weeds, and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity. When two approach each other, they often twist their tails together, and struggle to separate, or attach themselves to the weeds; this is done by the under part of their cheeks or chin, which is also used for raising the body when a new spot is wanted for the tail to entwine afresh. The eyes move independently of each other, as in the Chameleon; this, with the brilliant changeable iridescence about the head, and its blue bands, forcibly reminds the observer of that animal.”*

It must not be forgotten that the Chameleon entwines its prehensile tail around the twigs of plants when watching for prey, thus presenting another analogy between these highly curious animals of different Classes.

* Yarrell's Brit. Fishes, ii. 453.

ORDER III. PLECTOGNATHI.

(*Fishes with soldered jaws.*)

THE skeleton in this Order is partly bony in texture, and partly cartilaginous, presenting a decided approach to the following group, in which the gristly structure wholly prevails. The ribs are present only as mere vestiges: the jaws are formed by the union (or soldering together, if we may so speak,) of the maxillary and intermaxillary bones, and the arch of the palate is united to the skull, so as to be deprived of independent motion. Hence the mouth in these fishes is small, powerless, and almost motionless. The gill-covers and gill-rays are imperfectly developed; and are concealed under the thick skin, leaving only a small orifice for the escape of the water from the gills. The body is destitute of true scales; the skin is either hard and leathery, and scored into lozenge-shaped divisions, or covered with hard bony spines, or soft and mucous. The form is usually short and thick, sometimes quite destitute of the proportions that we are accustomed to see in other fishes, and, as it were, deformed: the fins are commonly small, and often remarkable for their position or structure; there are no proper ventrals.

The Order before us is very limited in extent as compared with the others; the fishes which compose it, though presenting some curious

points of structure and economy, and therefore not without interest to the naturalist, are of little value; their flesh being in general rank and glutinous, and unfit for human food. Most of the species are natives of the tropical seas; though an individual occasionally strays into colder climates. We shall consider them as forming two Families, *Tetraodontidæ* and *Balistidæ*.

FAMILY I. TETRAODONTIDÆ.

(*Naked-toothed Fishes.*)

Instead of teeth arranged in some sort of serried order, the fishes before us have them united into masses, presenting externally no trace of individuality, but internally showing a number of parallel thin plates. The form of these masses of teeth resembles that of a parrot's beak, and they are covered with a common coat of ivory-like substance. They are continually renewed by the growth of the component plates, as the surfaces are worn down by grinding the sea-weeds and crustaceous animals that constitute the common food of the Family.

Most of the species have the skin covered with prickles, differing in number and strength, and capable of being erected. They are, in general, endowed with the power of inflating the body with air to a remarkable degree. One genus, that of the Sun-fishes (*Orthogoriscus*), is destitute of both these characters; but it is marked by an equally curious peculiarity of form: the tail being so short, and the posterior termination

of the body so abrupt, that the observer is apt to imagine that he looks upon the anterior half of a fish, cut across through its middle. These are fishes of gigantic size, which are sometimes taken in the British seas.

About a hundred species are enumerated as belonging to the Family, the great majority of which are confined to the warm parts of the ocean. All are, we believe, marine in their habits.

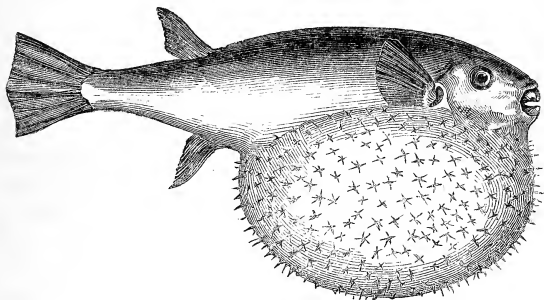
GENUS *TETRAODON*. (LINN.)

A depressed line, passing down the front of the aggregated teeth in both jaws, gives to the fishes of this genus the appearance of possessing four great teeth, two above and two below, whence the generic appellation. The body, either wholly or at least on the under parts, is studded with prickles, varying in size and in number. In some species, indeed, these are so small and so imbedded in the soft mucous skin, as not to be perceptible in a living state, but drying or preservation in spirit reveals them.

“The species of this genus,” observes Dr. Roget, “are remarkable for being provided with the means of suddenly assuming a globular form by swallowing air, which passing into the crop or first stomach, blows up the whole animal like a balloon. The abdominal region being thus rendered the lightest, the body turns over, the stomach being the uppermost part, and the fish floats upon its back, without having the power of directing itself during the state of forced distension. But it is while thus bloated and pas-

sive, at the mercy of the waves, that this animal is really most secure; for the numerous spines with which the surface of the body is universally beset are raised and erected by the stretching out of the skin, thus presenting an armed front to the enemy on whatever side he may venture to begin the attack.”*

Specimens of a species called Pennant's Globe-fish (*Tetraodon Pennantii*, YARR.) are occasion-



PENNANT'S GLOBE-FISH.

ally taken on the coast of Cornwall. It is about a foot and a half in length; of a rich blue colour on the superior parts, and silvery white on the sides and belly, studded all over the last-named part, which is capable of inflation, with clusters of spines, each group consisting of four radiating from a centre.

* Bridgewater Treat. i. 433.

FAMILY II. BALISTIDÆ.

(File-fishes.)

In this Family the muzzle from the eyes onward is conical, or pyramidal in form, terminating in a small mouth, with distinct teeth in both jaws. The skin is either rough and marked with lines or scorings crossing each other at definite angles, or else covered with angular bony plates. The air-bladder is large, strong and oval. There are one hundred and ten species known, all natives of the warmer seas; and they form two Sub-families.

1. *Balistina*. The File-fishes. In these the body is compressed, more or less oval, and covered with a granulated, hard, leathery skin, marked all over with a scored pattern of lozenges, the crossing lines being perfectly smooth, while the rest of the skin is rough. They have eight teeth in one row in each jaw.

2. *Ostracionina*. The Trunk-fishes. These have the body angular, four or three-sided, covered with angular plates of solid bone soldered together, and forming a sort of inflexible box, with openings for the mouth, the fins, the tail, and the gill-aperture. They have ten or twelve conical teeth in each jaw.

GENUS *BALISTES*. (LINN.)

The body, which generally assumes an oval form, more or less pointed at each end, and often compressed, is invested with a leathery skin,

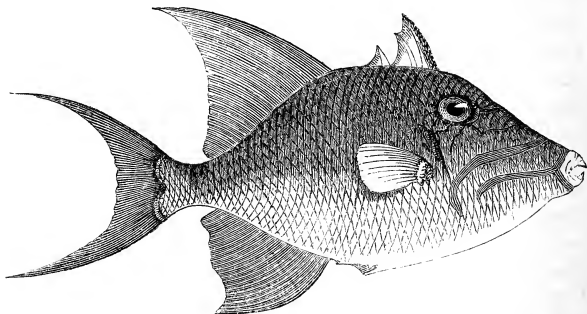
covered with minute rough points, except in regular lines which cross each other, and mark off the whole surface into lozenge-shaped divisions. The appearance is so much like that of a smith's rasp or file, as to have suggested the name of File-fish, by which the genus is commonly known. There are two dorsals, of which the first is composed of three spinous rays. The ventrals have each a strong bony spine, without membranes; the other fins are generally much developed. In some species the sides of the tail are armed with rows of sharp prickles.

The first ray of the front dorsal is a strong pointed bone, studded along its anterior side with hard rough points. It is a powerful weapon, the effect of which is heightened by an interesting contrivance. When it is erected, which is effected with a kind of spring or catch, no force can depress it, but the least touch applied to the second or third, lowers the whole fin in a moment. Hence it is named *Balistes*, from the ancient machine which shot darts at an enemy. The structure by which this effect is produced is thus explained by Professor Owen. "The first spine is articulated by a very remarkable joint to [a broad bony plate on the top of the head]; its base is expanded and perforated, and a bony bolt passes freely through the ring. When this spine is raised, a depression at the back part of its base receives a corresponding projection from the contiguous base of the second ray, which fixes it like the hammer of the gun-lock at full cock; and it cannot be forced down till the small spine has been depressed, as by pulling the trigger: it is then received into a groove on the

supporting plate, and offers no impediment to the progress of the fish through the water.”*

These fishes are generally adorned with rich and brilliant colours, often arranged in diagonal lines or bands; they abound in the seas of hot climates, generally swimming among the rocks, like the *Chætodons*, which they not a little resemble. Some have the body set with curiously branched filaments. Their flesh is rank and unwholesome.

We illustrate the genus by a description and figure of *Balistes velatus* (BLOCH.), a West In-



FILE-FISH.

dian species which has fallen under our observation. The dorsal and each lobe of the caudal are produced into long pointed filaments. The body is purplish brown on the upper parts, with the throat and belly pale buff. Several curved lines and bands pass across the face, of a rich azure hue, with yellow edges. The fins are blackish purple.

* Comp. Anat. ii. 69.

ORDER IV. CARTILAGINEI.

(*Cartilaginous Fishes.*)

THE largest and most formidable of all fishes are found in this Order. "The peculiar structure of their skeleton, which gives rise to their name, admits of these animals continuing to grow as long as they live; the consequence of which is, that as they inhabit the wide ocean, and have few enemies, they are sometimes met with of such an enormous size that their weight and dimensions are almost incredible."*

The great essential character of the Order is the nature of their skeleton. Their bones have but a very small quantity of earthy matter in their composition; and what is present is deposited in grains, and not in distinct fibres. The skull is not divided into separate bones, but is formed in a single piece; yet ridges, furrows, and holes on its surfaces, enable the anatomist to discover the portions, which in other fishes are distinct, though here soldered, as it were, together. Even bones, that in other fishes constitute moveable joints, are not always distinct in this Order; the *vertebræ* or joints of the spine, for example, are, in some of the Rays, united into a single mass; and in other genera, some of the bones of the face are quite wanting. The bones of the jaws, known to anatomists under the names

* Swainson, Nat. Hist. of Fishes, i. 118.

of *maxillaries* and *intermaxillaries*, are reduced, throughout the Order, to mere rudiments concealed beneath the skin: and the functions proper to them are performed by other bones of the mouth, as the *palatals*, and the *vomer*.

Most persons who have ever looked at the backbone of any ordinary fish that is brought to table,—a Mackerel, a Cod, or a Salmon,—are aware that each *vertebra* is hollowed into a funnel-shaped cavity on each face, which is filled with a gelatinous substance: and that the centre is pierced with a slender hole, through which this jelly passes, thus forming a continuous cord, dilated and contracted alternately, throughout the spine. In many species of this Order the gelatinous cord varies very little in its diameter; and in some, the central tube of communication is so much enlarged as to reduce the solid part to a mere ring of cartilage.

It is observable that this Order presents us with some fishes having peculiarities of organization of a higher type than is found elsewhere in the whole Class, exhibiting a close affinity with the Reptiles; and even making a distinct approach to the Cetaceous MAMMALIA. “The viviparous Sharks,” says the learned author of *Horæ Entomologicæ*, “such as the Basking-Shark (*Selache maxima*, Cuv.), with their ear more perfectly organized than that of other fishes, and their body destitute of scales, the particular disposition of their fins, and their closed *branchiæ*, all indicate at what place we are to enter among the fishes upon leaving the Cetaceous quadrupeds.”*

* Hor. Entom. 272.

On the other hand, the scale of organization descends to a lower point in the Cartilaginous than any reached in the Osseous Orders. In the extreme forms the skeleton becomes obsolete; the spine is no longer divided into *vertebræ*, but is reduced to a soft, flexible, transparent, and slender column or thread of cartilage; and the animals can only with the utmost difficulty be distinguished from Worms.

Thus it seems probable that in a truly natural arrangement, as the illustrious Cuvier has suggested, the CARTILAGINEI ought not to be placed either above or below other Fishes, but rather as forming a parallel series, or Sub-Class, as the MARSUPIALIA form a series of MAMMALIA, parallel with the PLACENTALIA.

The Cartilaginous Fishes are not very numerous, when compared with the other Orders: they are, however, widely scattered, some of them being found in all seas, from the equator to the seas surrounding either pole. They are almost exclusively marine; the Sturgeons and the Lampreys, however, are exceptions, inhabiting rivers. Five Families are included in this Order, named, respectively, *Acipenseridæ*, *Chimæradæ*, *Squalidæ*, *Raiadæ*, and *Petromyzonidæ*.

FAMILY I. ACIPENSERIDÆ.

(*Sturgeons.*)

The Sturgeons have their gills free, like other fishes, with a single opening, which is comparatively wide, and protected by a large, oval, radiated plate, as a gill-cover; there are no gill-

rays. The gill-plate, being furnished with a membranous margin, can close the aperture so accurately as to exclude water, and even air. The body is long, and tapering gradually to the tail, which is furnished with a caudal fin of remarkable structure. It is unequally forked, the upper lobe being considerably the longer; but this is not the only difference, for (as in the Shark, which exhibits the same form of the caudal,) the upper lobe is penetrated by the terminal joints of the spinal column, which run through its centre to the extremity; the lower lobe is formed only of rays. The body and the head are covered with large bony plates, those on the head of various angular forms, fitting into each other, those on the body arranged in longitudinal rows, with their centres rising into spines pointing backwards. The mouth, situated beneath the head, is small and toothless; it is placed on a sort of foot of three joints, by means of which it is capable of considerable protrusion.

These are fishes of large size, some, indeed, attaining gigantic dimensions; they inhabit rivers, lakes, and inland seas, and chiefly in the northern regions of the globe. They migrate at certain seasons to the sea, but deposit their spawn in freshwater. Twenty-four species are enumerated by the Prince of Canino as belonging to the Family, including one or two singular species of North America, which, with most of the characters above-mentioned, have the snout prolonged into a broad, leaf-like, bony plate.

GENUS *Acipenser*. (LINN.)

In addition to the characters already detailed, the Sturgeons have the snout more or less prolonged and pointed, and furnished, on its under surface, with several *cirri* or beards, which hang down in front of the tubular, protrusile mouth. The fins are rather small, and, with the exception of the pectorals, are all placed far behind. The flesh in general is wholesome and agreeable; the roe, which is of considerable bulk, is made into a substance called *caviare*, held in high estimation in some parts of Europe; isinglass of the best quality, is made of the inner coats of the large and thickened air-bladder; and the skin is sometimes made into leather, or prepared as a substitute for window-glass. Hence these fishes are the subjects of important fisheries, especially in the east of Europe. The Russian fisheries, on the Caspian Sea, are very valuable; three species inhabit that great inland lake,—the Common Sturgeon (*Acipenser sturio*), the Great Sturgeon (*A. huso*), and the Sevruga (*A. helops*). The number of fishes taken in a single season is immense; of the first species named, three hundred thousand; of the second, one hundred and three thousand; of the third, one million three hundred thousand; are considered as the annual average. The products of isinglass and caviare, exclusive of the flesh, which is preserved in various ways, and is a valuable article of merchandise, are alone worth more than 100,000*l.* per annum.

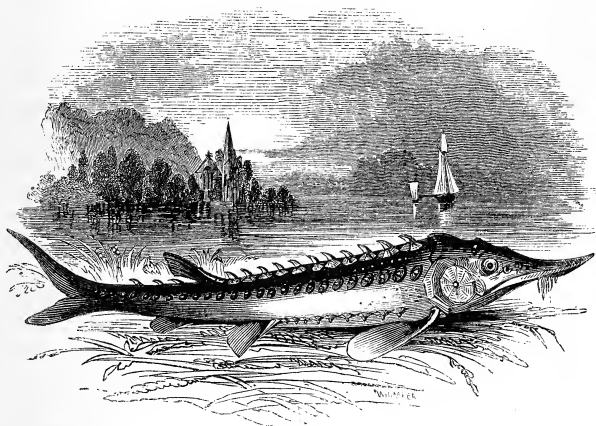
We have said that these fishes attain large dimensions; the Common Sturgeon, which occasionally ascends the rivers of this country, has

been taken of the weight of four hundred and sixty pounds; and the Great Sturgeon attains a length of twenty feet, and a weight of two thousand pounds; of which the roe, which constitutes its chief value, weighs one fourth part.

The Sturgeon, when taken in the Thames, is called a Royal fish, by which is meant, that it ought to be, and formerly was, presented to the sovereign, for the royal table. The flesh, which is much more solid than that of fish generally, is considered as a great delicacy; it is usually stewed with a rich gravy, and is commonly compared to veal. It was held in high repute among the luxurious Romans, in the times of the empire: according to Pliny it was brought to table with much pomp, adorned with garlands; the slaves who carried the dishes were also decorated in a similar manner, and marched to the sound of music.

Caviare is prepared in the following way. The roes, taken out and placed in tubs, are cleansed with water; the fibrous parts, by which the ova are connected, are removed, and the spawn is rinsed in white wine, or vinegar, and spread to dry. It is then put into a vessel and salted, being crushed down at the same time with the hands, and afterwards inclosed in linen bags to drain off the moisture. Finally, it is packed in tubs, pierced in the bottom, that any remaining moisture may yet drain off, and closed down for domestic use or exportation. Sometimes it is said to be preserved, after having been salted and seasoned, by being rolled up into large balls, and immersed in vessels of oil; or the rolls are inclosed in wax, so that the air may be more effectually excluded.

To make isinglass, the air-bladders are washed carefully in water, and the outer membrane is removed; what remains is then rolled up in a cloth, and kneaded with the hands, until it has become thoroughly softened. Each bladder is then moulded into a cylindrical form, dried in a gentle heat, and bleached with the fumes of brimstone.



THE STURGEON.

The Common Sturgeon has the snout slender and pointed; the body is somewhat five-sided, being studded with five rows of bony plates, that run down the whole length; one along the back, another along each side, and two more bordering the belly. These plates are oval, with a curved spine in the centre of each. The ground colour of the body is brown on the upper parts,

and silvery-white beneath; the plates are bone-white.

FAMILY II. CHIMÆRADÆ.

(*Chimeras.*)

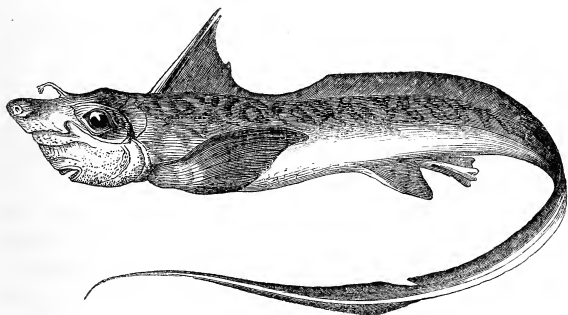
The name *Chimæra*, that of a monstrous compound being in classic fable, was applied by Linnæus to a cartilaginous fish, on account of its singular and uncouth appearance. One species alone was known to him, a native of the northern seas, but a second, if not a third, has since been added from the southern hemisphere.

The *Chimæradæ* have much resemblance to the Sharks in external appearance; having the same general form, and nearly the same arrangement of the fins. In the peculiarities of their respiratory organs, they hold an intermediate place between these fishes and the Sturgeons, for while there is only one external gill-aperture on each side, yet the gills are not properly free, but adhere by portions of their edges, so as to leave five openings communicating with the external aperture. Their jaws are merely rudimentary; hard undivided plates supply the place of teeth, four above and two below.

GENUS *CHIMÆRA*. (LINN.)

The body is lengthened, terminating in a slender filament; there are two dorsals, the first short, high, and preceded by a stout spine; the second low and very long. The males are distinguished by three pointed bony appendages to

the ventrals, and by a very singular hoe-like horn on the snout, bent forwards and tipped with spines. In the Northern Chimæra (*Chimæra monstrosa*, LINN.) the head is strangely uncouth, the snout ascending in a blunt point; the mouth far below, small; the face and cheeks scored with



CHIMÆRA.

irregular waved furrows. The colours are beautiful; many shades of rich brown, on a shining white ground; the eyes are particularly large and brilliant. It attains three feet in length, and is sometimes seen on the northern coasts of Scotland. From its pursuit of the shoals of Herrings, on which it principally feeds, it is sometimes called the King of the Herrings. The female deposits large leathery eggs or capsules, flattened, with velvety margins, having some resemblance to those of Sharks or Rays. These eggs are esteemed by the Norwegians, who eat them in pastry; the flesh of the animal is coarse, hard, and uneatable. An oil is extracted in copious

quantity from the liver, to which medicinal properties are attributed.

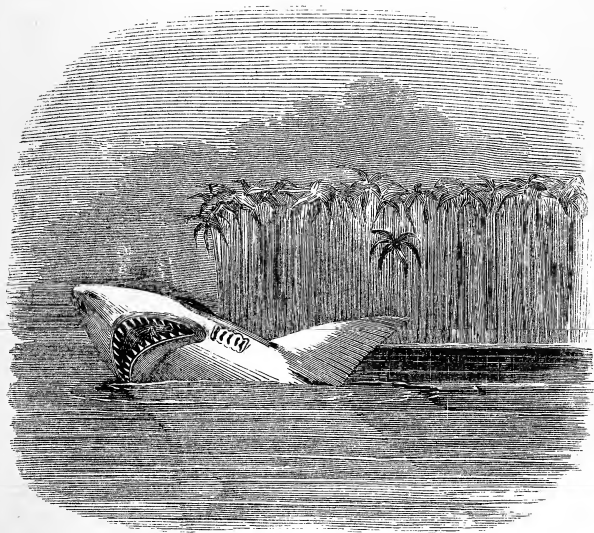
FAMILY III. SQUALIDÆ.

(*Sharks.*)

We now come to a Family which contains the most highly organized members, not only of their Order, but of the whole Class of Fishes. They are generally of large size, sometimes gigantic; are carnivorous and voracious; and some of them are universally dreaded for their ferocity, their appetite for human flesh, their strength, and the formidable array of teeth with which their mouth is furnished. The White Shark (*Carcharias vulgaris*), that terror of the tropical seas, has been repeatedly known to cut a man's body in twain at a single snap; and accounts are current of human bodies having been found entire in the bodies of these terrible monsters. Nor will this seem incredible when we consider that this species is sometimes found twenty feet in length.

This and the following Family agree in having the gills attached at their outer margin, with a separate orifice to each, through which the water escapes. These orifices are commonly five in number. In the Sharks the body is lengthened, and of the usual fish-form, that is, tapering from behind the head to the tail, with but little swelling in the middle; the muzzle is more or less pointed, and projects, so that the mouth opens beneath; the nostrils also are situated beneath the snout. All the fins are distinct and free;

there are usually two dorsals, two large pectorals, two ventrals with (in the males) two large appendages at their inner edge, an anal, and a caudal of two unequal lobes, as before described in the Sturgeons. The body and fins are covered with a hard leathery skin, almost always rough



WHITE SHARK.

to the touch if the hand be passed from the tail upwards. This roughness arises from the presence of small angular *spiculæ* of crystalline appearance, imbedded in the skin, and fits the skin and fins of various species to be used for polishing cabinet-work. In some species the skin is studded with curved spines.

The teeth of the Sharks constitute a most formidable apparatus. They are generally triangular, very sharp-pointed, and often have a small point on each side the principal one; they are flat, and the edges are keenly cutting, so that they resemble lancets; moreover, in some cases, the edges themselves are notched into minute saw-like teeth. Each of these lancet-teeth alone, in a Shark of considerable size, would inflict a severe gash; what then must be the effect of a whole mouthful of such weapons, above and below, arranged in serried order, rank behind rank, and moved with the force of powerful muscles? The teeth of a fossil Shark are found two inches and a half in diameter, from base to point.

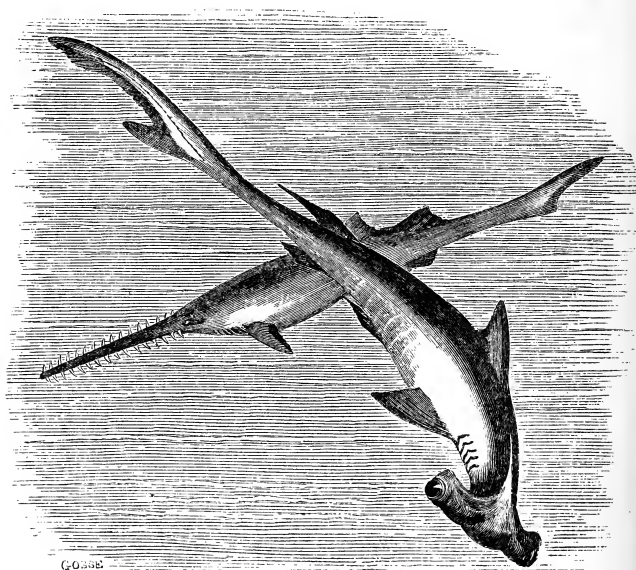
The mode by which the race of these formidable creatures is continued, differing as it does so greatly from that of most other fishes, is exceedingly curious. The Shark, instead of depositing some millions of eggs in a season, like the Cod or the Herring, produces two eggs, of a square or oblong form, the coat of which is composed of a tough horny substance; each corner is prolonged into a tendril, of which the two which are next the tail of the enclosed fish are stronger and more prehensile than the other pair. The use of these tendrils appears to be their entanglement among the stalks of sea-weeds, and the consequent mooring of the egg in a situation of protection and comparative security. Near the head there is a slit in the egg-skin, through which the water enters for respiration, and another at the opposite extremity by which it is discharged. That part of the skin which is near the head, is

weaker and more easily ruptured than any other part; a provision for the easy exclusion of the animal, which takes place before the entire absorption of the *vitellus* or yolk of the egg, the remainder being attached to the body of the young fish, enclosed in a capsule, which for a while it carries about. The position of the animal, while within the egg, is with the head doubled back towards the tail, one very unfavourable for the process of breathing by internal gills, and hence there is an interesting provision made to meet the emergency. On each side a filament of the substance of the gills projects from the gill-opening, containing vessels in which the blood is exposed to the action of the water. These processes are gradually absorbed after the fish is excluded, until which the internal gills are scarcely capable of respiration. How curious an analogy we here discover with the Frogs and Newts among the Reptiles; and how impressively do we learn the Divine benevolence, when we find that the object of so much contrivance and care is the dreaded and hated Shark!

In some species the horny capsules in which the young are enclosed at birth are destitute of the filamentous prolongations of the angles; in some they have but two projecting points, one end being rounded; while other species, as the Penny Dog (*Galeus vulgaris*), and Smooth Hound, (*Mustelus lævis*), of our own shores, bring forth their young alive and fully formed, without any capsule or covering at all.

A hundred and fourteen species are reckoned by Prince Bonaparte to belong to this Family;

some or other of which are scattered over all seas. Fifteen are enumerated among British Fishes, either as habitual residents in our waters, or as accidental stragglers. Considerable difficulty is felt by naturalists in the attempt to subdivide the family into natural groups; not from the number of the species so much as from the diversities of form and structure that exist among them. The following is the arrangement proposed by Mr. Swainson.



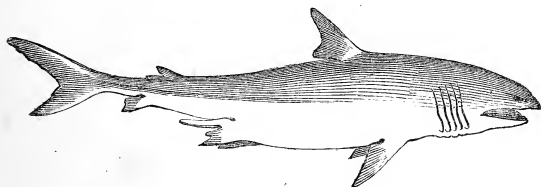
HAMMER SHARK AND SAW FISH.

1. *Zygænina*. The Hammer-heads. These have

an obvious and well-marked character in the form of the head, which is enormously dilated, so that the eyes appear placed at the ends of long projections. (See figure of *Zygæna laticeps*, an Indian species, on page 15.) These fishes attain a large size, and are said to be ferocious and formidable; one is occasionally taken on our coasts.

2. *Pristina*. The Saw-fishes. These are Sharks with many characters of the Rays; distinguished by the snout being prolonged into a straight flat bony blade, along the edges of which are set pointed teeth, directed outwards. This well-armed sword is a formidable weapon, which it is said the ferocious Saw-fish frequently buries in the flesh of the Whale and other marine animals. The preceding engraving represents the singular forms of these two Sub-families.

3. *Squalina*. The True Sharks. These have the ordinary form, the nose being somewhat pointed, the body slightly swelling behind the head. There are two dorsals, which have no



BASKING SHARK.

spines before them; and there are no air-holes (*spiracles*) behind the eyes. To this group, which far exceeds any of the others in the num-

ber of its component species, belong the giants of the race, the Basking Shark (*Selachus maximus*), thirty-six feet in length, the Blue Shark (*Charcharias glaucus*), the Fox Shark (*C. vulpes*), and the dreaded White Shark (*C. vulgaris*).

Many thrilling anecdotes of the fatal voracity of this last named monster of the deep are on record. One of these is recorded by a painting in Christ's Hospital, London. The late Sir Brooke Watson was swimming at a little distance from a ship, when he saw a Shark making towards him. Struck with terror at its approach, he cried out for assistance. A rope was immediately thrown to him; but even while the men were in the act of drawing him up the ship's side, the ferocious creature darted after him, and at a single snap, tore off his leg.

The horrors inflicted on the miserable sufferers by the shameful traffic in men, during the transit across the Atlantic, are heightened by these ferocious animals. Their instinct apprises them of the probability of prey; the air, tainted with the effluvia of a multitude of human beings crowded together in a tropical climate, probably awakening their vigilance and whetting their appetite. It is affirmed that numbers of Sharks almost invariably attend every slave-ship throughout her voyage, crowding around her stern, awaiting with eager expectation the unceremonious committal to the deep of the numerous wretches who fall victims to suffocation, disease, or despair.

“Here dwells the direful Shark. Lured by the scent
Of steaming crowds, of rank disease, and death,
Behold! he rushing cuts the briny flood,
Swift as the gale can bear the ship along;

And, from the partners of that cruel trade
Which spoils unhappy Guinea of her sons,
Demands his share of prey, demands themselves."

A dreadful instance of the voracity of these formidable animals occurred a few years ago among the Society Islands. Upwards of thirty natives were passing from one island to another, in a large double canoe, which consists of two canoes fastened together, side by side, by strong horizontal beams, lashed to the gunwales by cordage. Being overtaken by a storm, the canoes were torn apart, and were incapable, singly, of floating upright. In vain the crew attempted to balance them, they were every moment overturned. Their only resource was to form a hasty raft of such loose boards and spars as were in the craft, on which they hoped to drift ashore. But it happened, from the small size of their raft, and their aggregated weight, that they were so deep in the water, that the waves washed above their knees. Tossed about thus, they soon became exhausted with hunger and fatigue; when the Sharks began to collect around them, and soon had the boldness to seize one and another from the raft, who being destitute of any weapon of defence, became an easy prey. The number and audacity of these monsters every moment increased, and the forlorn wretches were one by one torn off, until, but two or three remaining, the raft at length, lightened of its load, rose to the surface, and placed the survivors beyond the reach of their terrible assailants. The tide at length bore them to one of the islands, a melancholy remnant, to tell the sad fate of their companions.

Of the immense numbers of these fishes that exist in the tropical seas, some idea may be formed from the fact that in a single harbour (that of Kingston), on the coast of Jamaica, from one hundred to one hundred and fifty thousand are destroyed annually. These are principally young ones, which are taken in numbers at every haul of the seine. On our own coast Sharks (not, however, of this species) are very numerous. Mr. Couch says of the Picked Dog-fish (*Spinax acanthias*), "I have heard of twenty thousand taken in a seine at one time." These also were young ones. But they have doubtless many enemies; and few of the young which swarm in such incredible numbers, live to attain adult age and dimensions.

4. *Spinacina*. The Dog-fishes. These are readily recognised by the spiracles or air-holes which are placed, one on each temple, just behind the eye. The dorsals in several of the genera are each preceded by a strong spine. This also is a numerous group, and includes most of the British Sharks.

5. *Squatinina*. The Angel-fishes. This is the form by which the Sharks merge into the Family of the Rays. It is much depressed, with the head broad, flat, and rounded; the eyes are placed on the summit of the head, and the mouth at the extremity, while the gill-apertures are beneath. The pectorals are enormous, as are the ventrals, giving to the fish that rhomboidal outline common to the Skates: the dorsals also are placed far back. This subdivision is represented by a British species, *Squatina angelorum*, of large size and great voracity, and held in no esteem.

GENUS *SCYLLIUM*. (Cuv.)

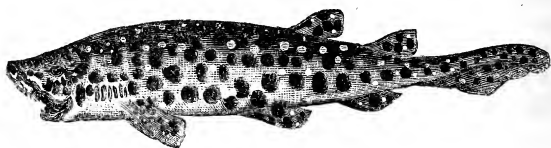
In this genus, belonging to the fourth of the above Sub-families, we find spiracles on the temples distinct, though small. There is an anal fin, as well as two dorsals; the first dorsal placed opposite or behind the ventrals, the second behind the anal: the head is short, and the muzzle rounded; the nostrils, pierced near the mouth, are continued by a fissure in the upper lip, forming valves. The teeth are small and acute, with a small point on each side of the principal lobe. The caudal is lengthened, oblique, irregularly lobed, and truncate (or apparently cut short) at the tip.

The names of Dog, Hound, Beagle, and such like, commonly applied to the common Sharks of this and other similar genera, are believed to have reference to their habit of following their prey in packs. They may have allusion also to the prevalent style of colouring in these fishes; spots of varying size, of black, brown, or liver-colour profusely scattered over a light ground, often clouded with brown and yellow.

Like the rest of the Family the Dog-fishes are ground feeders; a habit indicated by the position of the mouth beneath the projecting snout. This habit is not at variance with the fact that several species, such as the Basking, the White, and the Blue Sharks, frequent the warm surface of the sea, at certain seasons, as this has reference to other requirements in their economy.

We have two British species of this genus, of which the Large-spotted Dog, or Bounce

(*Scyllium catulus*, LINN.), here represented, is the handsomer and the larger. It attains a length of three feet; is of a brownish grey hue on the upper parts, and whitish beneath; the whole elegantly studded with large round spots of black, or deep brown.



SPOTTED DOG-FISH.

The Dog-fishes are excessively voracious, and, in the pursuit of prey, seem at times quite fearless of man. They follow vessels with eagerness, seizing everything eatable that is thrown overboard; they have even been known to dart at fishermen, and at persons bathing in the sea; though their comparatively small mouths, and their weakness, prevent their ability to inflict serious mischief in this way. They are, however, hated by the fishermen on account of the depredations they commit on more valuable fishes than themselves, great quantities of which they devour, when taken in the nets. The Dog-fish itself is often captured both by the net, and by the hook; but is perfectly valueless when caught; except for the trivial use that is made of the skin in polishing.

“On the coasts about Scarborough, where the Haddocks, Cod, and Dog-fish, are in great abun-

dance, the fishermen universally believe that the Dog-fish make a line or semicircle, to encompass a shoal of Haddocks and Cod, confining them within certain limits near the shore, and eating them as occasion requires. Haddocks and Cod are always found near the shore, without any Dog-fish among them; and the Dog-fish are found farther off, without any Haddocks or Cod; and yet the former are known to prey upon the latter; and, in some years, they devour such immense numbers as to render this fishery more expensive than profitable.”*

FAMILY IV. RAIADÆ.

(*Rays.*)

In the flattened form of the Saw-fish (*Pristis*), and in the great enlargement of the pectorals in the Angel (*Squatina*), we saw distinct approaches made by the Family of the Sharks to that of the Rays. In these the pectorals are enormously dilated, their bases, which are continuous with the body, extending from the base of the tail to the head, and sometimes stretching out in front of the head in the form of lobes. Hence the ordinary shape of these fishes is more or less rhomboidal, or square, the snout forming one corner, and the tail projecting from the opposite, the other two corners being the angles of the pectoral fins. The body is broad, but thin and flat; and a common skin invests both it and the fins: the ventrals are commonly large, and in the males are furnished with appendages resembling those

* Bingley's Anim. Biog. iii. 316.

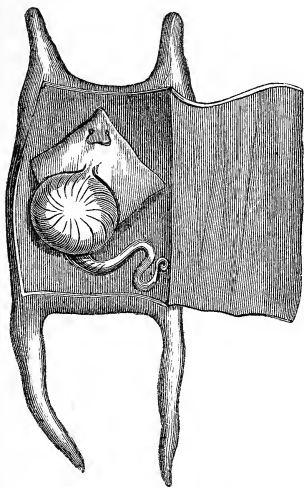
of the Sharks: the dorsals are two, sometimes three in number, small, and placed very far back upon the slender tail; sometimes, indeed, close to its extremity; a minute caudal is occasionally seen, but more frequently wanting; the dorsals also are, in some species, obliterated.

The eyes, and the temporal spiracles, are placed on the upper surface: the latter are much larger than in the Sharks, often exceeding the size of the eyes; they communicate internally with the mouth and gills. The mouth, the nostrils, and the gill-openings are placed on the under-surface, and quite concealed from view in the ordinary position of the fish as it flounders along on the bottom of the sea. The gill-openings agree with those of the Sharks in number, form, and structure. The mouth is small, and set with numerous teeth, which are arranged in close array like paving-stones; they are more or less square, and flat; but in old males, the middle ones assume a pointed form, overlapping one another, and pointing backward towards the throat.

As in many of the Sharks, the eyes are furnished with a *nictitating membrane*, or skin, which can be drawn over the eye-ball at pleasure, serving the purpose of an eyelid.

The young of the Rays are enveloped at birth, like those of some of the Sharks, in capsules of thin horn or leathery substance. They are generally more square in form, with the angles produced, but not attenuated to long filaments. The accompanying figure represents the egg-capsule of the Common Skate, frequently found on our sea-beaches, and commonly called Skate-

purses. In the north of England, they are called Skate-barrows, from their obvious resemblance in form to a hand-barrow. As the inclosed young grows, the angular projections of the pectoral fins bend over upon the body, and thus room is afforded for the little creature to attain that



EGG OF SKATE.

size and maturity which are requisite for it, when it forces its way out at an elastic crevice, to procure its living in freedom.

The Rays, like the *Pleuronectidæ* or Flat-fishes of the Osseous Orders, to which they possess many curious analogies, are strictly ground-feeders. They habitually grovel along on the soft muddy bottom, moving with a peculiar undu-

lating action of the pectorals. The great size, however, of these fins indicates that, on occasion, they can shoot along with great swiftness. They are very voracious, devouring any fishes that they can master, as well as *crustacea*, and shelled *mollusca*; the strong flat teeth, with which their jaws are paved, are able to crush to powder the stoutest shells of lobsters and crabs. Some of the species, especially those of tropical seas, grow to an immense size, and are ferocious in proportion to their dimensions. Specimens of the *Cephaloptera* have been seen twenty five feet in length, and thirty in breadth; and one was captured a few years ago at Barbadoes, which weighed three thousand five hundred pounds. Col. Hamilton Smith saw one of these monsters seize and carry down a man who was swimming in the sea near Trinidad.

About a hundred and thirty species are known to belong to this Family, all of which are marine. They are found in all seas, and the British coasts possess no fewer than sixteen. The following groups constitute the Sub-families of the Rays.

1. *Rhinobatina*. The Shark-rays. This form may be considered as almost equally partaking of the characters of the two Families whose names it conjointly bears. The body is much longer than broad, the tail is thick, and tapers gradually from the trunk; the snout is short and elongated. They mostly inhabit the Indian Ocean and the Red Sea.

2. *Torpedinina*. The Electric Rays. Here the tail is short and fleshy, but distinctly separated from the disk of the body, which is nearly

circular. The space between the pectorals and the head and gills, is occupied on each side by an apparatus capable of giving electric shocks of considerable force, though not equal in power to those of the *Gymnotus*. The organs consist of a number of cells exactly resembling the hexagonal cells of a honey-comb, subdivided by lateral membranes, and containing a transparent jelly-like fluid. In the magnificent physiological Museum of the Royal College of Surgeons, there are several beautiful representations, most exquisitely modelled, of these organs in connexion with the surrounding parts. Two species of these fishes are found on the British coast, often called Cramp-fish, and Numb-fish, from the effect produced on the nerves of any one who comes into contact with them.

The object of so singular a power is but imperfectly conjectured. The fish is voracious and carnivorous, and this endowment may enable it to disarm and subdue its prey, which otherwise might be too strong or too active to be overpowered. But Mr. Couch suggests another object, with high probability. He says;—"One well-known effect of the electric shock is to deprive animals killed by it of their organic irritability, and consequently to render them more readily disposed to pass into a state of decomposition,* in which condition the digestive powers more speedily and effectually act upon them. If any creature more than others might seem to require such a preparation of its food, it is the Cramp-

* "The bodies of animals killed by lightning do not become stiff, and decomposition goes on rapidly." (Yarrell's Brit. Fishes, ii. 544.)

Ray, the whole canal of whose intestine is not more than half as long as the stomach."

3. *Raiana*. The Skates. The rhomboidal or lozenge-shaped outline, is eminently characteristic of this group, which is the most numerous of the whole. The tail is moderately long and slender; furnished with two small dorsals, and generally terminated by a small caudal. The skin on the upper parts, particularly of the tail, is generally studded with asperities, tubercles, or curved prickles, but never armed with a long, serrated bony spine. Eleven of our British species belong to this group.

4. *Trygonina*. The Sting-rays. In these the head is surrounded and inclosed by the pectoral fins; the disk is somewhat rounded; the tail is long, and drawn out to a fine point; it is quite destitute of fins, but is armed near its base with a long and sharp, flattened, bony spine, the two sides of which form thin edges, cut into close, acute teeth,—a most formidable weapon. We have one British species, commonly called the Fire-flaire, of which Mr. Couch thus speaks. "The manner in which it defends itself shows its consciousness of the formidable weapon it carries on its tail. When seized or terrified, its habit is to twist its long, slender, and flexible tail round the object of attack, and with the serrated spine tear the surface, lacerating it in a manner calculated to produce violent inflammation." Other authors state that it is capable of striking its weapon with the swiftness of an arrow into its prey or its enemy, when, with its winding tail, it secures its capture.

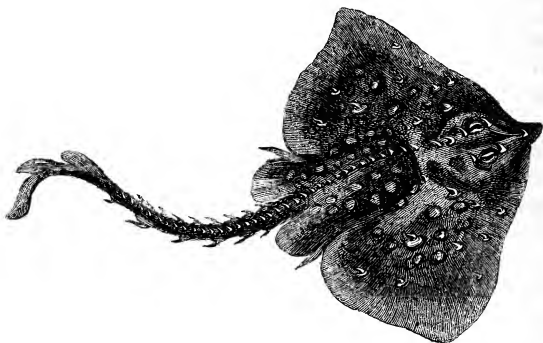
5. *Myliobatina*. The Eagle Rays. The pec-

torals are here greatly extended in breadth in proportion to their length, giving to the fish somewhat of the outline of a bat or a butterfly, dilated to gigantic dimensions. The anterior half of the head is free, and the eyes are placed at the margin of its summit. The teeth are arranged like broad flat paving stones, of regular forms: the tail is still more lengthened and attenuated than in the last sub-family, and is furnished with a serrated spine; it has a small dorsal near its base. Two species of this group are British, though very rare; one of these is the *Cephaloptera*, already mentioned as attaining colossal proportions, and displaying a fierce voracity in the tropical seas.

GENUS *RAIA*. (LINN.)

In this the most numerous genus of the Family, and the only one of any value to man, the disk is rhomboidal, greatly flattened; the tail is moderately slender, generally armed with rows of small spines; there is no notched spear, but two small dorsals near the tip are present, and sometimes the vestige of a caudal; the teeth are flattened, small, arranged in quincunx, the central ones becoming lengthened and pointed with age. The head and neck cannot be externally distinguished from the body, being included on the sides by the fore-part of the pectorals. The body is in general beset with sharp points, or spinous tubercles, sometimes small and few as in the Skate (*Raia batis*, LINN.); sometimes large and numerous as in the Thornback (*R. clavata*).

We select the latter species for illustration. It is abundantly common all round the British coasts, as well as on those of western and southern



THORNBACK.

Europe. It attains a diameter of two feet; is brown above with paler spots, and white beneath. The whole upper surface is rough with minute points, and is studded with an irregular number of large hooked spines. The structure of these is peculiar; each consists of an oval, rather thick disk of white bone, the centre of which rises into a sharp conical point curved backwards, the whole possessing a slight resemblance to one of the prickles on the stem of a rose-bush. A group of small ones of similar form surround each eye, and a row runs down the middle of the back in close series. The others are much larger, and irregularly scattered both over the body and the tail.

The Thornback is much eaten by the poorer

classes, both fresh and salted; the females and young are called Maids, and are considered best for the table. The flesh is in best condition in autumn and winter; becoming soft and woolly in spring and summer, which is the spawning season. Great numbers are caught, however, at these times, their approach to the shore rendering their capture more easy.

The acute spines with which so many of the Rays are studded, make them dangerous to handle; no doubt they may be considered as weapons of defence, if not of offence. It is observable that the long and flexible tail is always the most effectively armed: we have already seen how the spine of the Trygon is used; the learned zoologist to whom we are indebted for that information, has also described the defensive action of the Skate. "The point of the nose and the base of the tail are bent upwards towards each other: the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds."

FAMILY IV. PETROMYZONIDÆ.

(*Stone-suckers.*)

We have now arrived at the lowest examples of organization among Fishes, and consequently the bottom of the scale formed by the series of animals having an internal skeleton of bone and a vertebrated spine. Throughout the whole of this Order we have seen how the former character has become less and less distinct, the skeleton

being cartilaginous instead of bony; in the present Family the latter distinctive mark gradually disappears, the spine in the highest forms being "traversed by a single tendinous cord, filled internally with a mucilaginous fluid, without contractions and enlargements, so that the vertebræ are reduced to cartilaginous rings not easily distinguishable from each other, and, indeed, not cartilaginous through their whole circle," (Cuvier);—while in the lowest forms (*Amphioxus*), it is reduced to a simple cartilaginous column or thread, flexible, transparent, and scarcely to be distinguished from the horny pen enveloped in the flesh of some of the MOLLUSCA. Hence it has been disputed whether these minute creatures have a right to a place among VERTEBRATA; though the preponderance of opinion, founded on dissection and comparison of various organs, is in favour of such a position being assigned to them.

What we have further to say must be considered as applying principally to the more developed members of the Family. They have no pectorals nor ventrals; but foldings of the skin above and below the hinder parts of the body serve the purpose of dorsal, caudal, and anal; destitute, however, of supporting rays. The form is long, slender, and cylindrical, much resembling that of a worm; the mouth consists of a circular fleshy lip, with a cartilaginous ring supporting it. The gills are not comb-shaped fringes, but form sacs or pouches, by the union of two opposite ones along their edges.

These humbly organized members of the great Vertebrate division of animated beings are but

few in number, about fourteen species being the whole of those known to naturalists. They are found both in fresh and salt waters, principally in the northern parts of the world. Six of the number are enumerated as British.

GENUS *PETROMYZON*. (LINN.)

The Lampreys have a smooth, elongated, cylindrical body like that of an Eel. There are seven gill-apertures on each side; the mouth is circular, and its inner surface is studded with hard, crusted tubercles, answering the purpose of teeth. The tongue, which moves backwards and forwards like a piston, has two rows of small teeth. The skin, elevated in a fold around the extremity of the body, answers to dorsal, caudal, and anal fins.

The generic name applied to these fishes, *Petromyzon*, signifies Stone-sucker; and refers to a curious habit depending on the structure of the mouth. The animal applying its circular lip to the surface of a stone or other solid body in the water, draws in the piston-like tongue; a vacuum is thus produced in the mouth, while the pressure of the super-incumbent body of water causes the lip to adhere to the stone with immense tenacity, until by the protrusion of the tongue the vacuum is voluntarily destroyed.

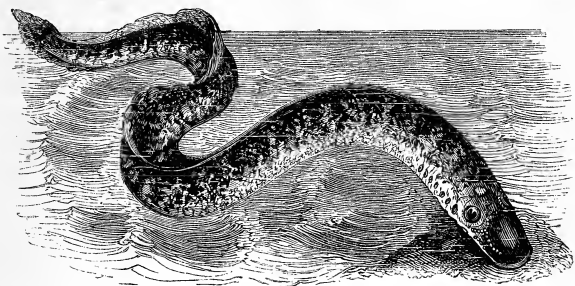
It is supposed that the Lamprey resorts to this singular expedient to prevent its being constantly carried down by the current of the rivers in which it lives; its powers of locomotion being feeble. But Sir William Jardine has shown that a much more obvious end is effected by the same

means, the formation of a fit receptacle for the deposited spawn. The Lamprey (*Petromyzon marinus*, LINN.) ascends the rivers of Scotland to breed about the end of June, and remains in them until August. These fishes “are not furnished with any elongation of the jaw, afforded to most of our freshwater fish, to form the receiving furrows at this important season; but the want is supplied by their sucker-like mouth, by which *they individually remove each stone*. Their power is immense. Stones of a very large size are transported, and a large furrow is soon formed. They remain in pairs, two on each spawning place, and while there employed, retain themselves affixed by the mouth to a large stone.”

The curious sucking-mouth is also serviceable to these fishes in enabling them to prey upon other fishes, which otherwise they would be ill-calculated to molest. They are known to attack fishes of large size, by fastening upon their flesh, and while affixed eating away the soft parts down to the bone, with their numerous small rasp-like teeth.

This species is called the Sea Lamprey to distinguish it from another, the River Lamprey, called also Lampern (*P. fluviatilis*). The latter is a permanent inhabitant of fresh water, but the former only ascends the rivers to spawn. Both are in high repute for the table, but the Lamprey is of much more value than the Lampern, on account of its superior size. It attains two or three feet in length; its ground colour is olive, handsomely spotted and mottled with deep green and dark brown; the edges of the fins are reddish; and the eyes are golden.

The Lamprey is taken in the Severn, near Worcester, and also in the Thames, but only in the summer months. The mode of taking this fish is very simple, and not difficult to one who



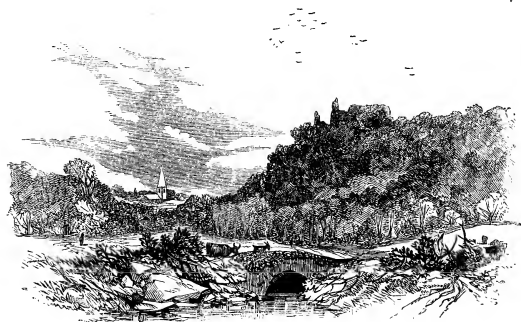
LAMPREY.

has a quick eye and steady hand. By the aid of a long staff armed at the end with several diverging hooks, the fishes are seized from the gravel at the bottom, where on a bright day they may be seen feeding, and are lifted into the boat.

In winter the Lampern affords employment to the Thames fishermen, when other fishes fail. It is taken in large numbers by means of wicker baskets placed across the weirs. Though much valued for the table, the Lampern produces a better remuneration by being sold to the Dutch fishermen, who use it as bait in the Cod fishery. Many thousands are exported alive, preserved in tanks of fresh water, in the course of the winter; and when the produce is divided, the share of each man engaged in the pursuit not unfrequently amounts to forty pounds sterling.

It is said to be an ancient custom for the city of Gloucester to present for the royal table, once every year, a pie of Lampreys, covered with a raised crust. King Henry I. met his death through his fondness for this worm-like fish; his mortal sickness having been produced by eating to excess of Lampreys, after a day spent in hunting.

There are one or two other species of the genus found in our waters, but they are small, and of no importance.



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